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July 8, 2011

Mr. Jeff Derouen
Executive Director
Public Service Commission
211 Sower Blvd.
Frankfort, KY 40601

Case No. 2011-00128

Dear Mr. Derouen:

Northern Kentucky Water District submits its responses to the Commission's data request of July 1, 2011. The application was filed on April 15, 2011 and included the critical timeline for the various stages of the project. As you may recall and as reflected in my letter to you of June 6, 2011, an order is needed by July 24, 2011 to assure that the lower than expected bids, which expire on August 31, 2011, do not expire.

Because of the time remaining to complete the review process, the District has submitted its responses in a very short time frame and is committed to make every effort to assist you and your staff in its analysis of the application. The following dates are available for an informal conference with the staff to provide clarification or additional information about these responses if you believe such a conference would be helpful.

Monday afternoon, July 11
Wednesday afternoon, July13

Thank you for your assistance with these matters.

Very truly yours,

John N. Hughes

John N. Hughes
Attorney for NKWD

1. Describe Northern District's current plans, aside from the proposed facilities, to expand the capacity of other facilities of the Taylor Mill Water Treatment Plant.

   Answer: The rated capacity of the Taylor Mill Treatment Plant will not be increased with the current Advanced Treatment project. The District has no plans to expand the capacity of the Taylor Mill Treatment Plant or the Fort Thomas Treatment Plant within the planning period through 2030. The current plan to meet future increased demand projections is to increase treatment capacity at Memorial Parkway Treatment Plant through several projects between year 2025 and 2030.

2. Describe Northern District's contingency plans for providing water service to its customers in the event of a service disruption at the Fort Thomas Water Treatment Plant.

   Answer: In the event of a service disruption to the Fort Thomas Treatment Plant lasting more than one day, or possibly less, the District would utilize its Emergency Supply Agreement with the Boone Florence Water Commission, Boone County Water District, and City of Florence to take water from up to six interconnections with their systems. These interconnections would supply water to the largest pressure zone, which accounts for about 30% of the normal water use. The District would also utilize the Memorial Parkway Treatment Plant to supply as much water to Campbell County as possible, although shortages would exist without rationing. A Level 4 conservation measure as described in the District's Water Shortage Response Plan would be implemented for Campbell County. The Taylor Mill Plant would be used to supply water to the remainder of Kenton County not served by the emergency interconnections, with the exception of the Covington area. The Covington area relies solely on gravity feed from the clearwells at the Fort Thomas Treatment Plant. This area accounts for about 15% of the system's normal demand and would have no water once the water stored in the clearwells were depleted. A Level 4 conservation measure as described in the District's Water Shortage Response Plan would be implemented for Covington in Kenton County.

3. a. State the maintenance costs associated with the use of vegetative roofs and compare these costs to those associated with the use of standard roofs.

Answer: The roofing manufacturer's services will cover the maintenance costs for the first 2 years, and the manufacturer's 20-year warranty will cover any failures in that period as well, which is the same as a traditional roof. It is expected the District's costs after the first 2 years will be limited to weeding and any watering needed to supplement shortages in rainfall. The costs for weeding have not been projected, but weeding once a year is anticipated. Watering is weather dependent and has not been calculated.

3. b. State whether the costs associated with the maintenance of vegetative roofs are reflected in the "Additional Costs and O&M" set forth in Exhibit D of Northern District's Application.

Answer: The labor and maintenance costs shown in the "Additional Costs and O&M" set forth in Exhibit D is believed to be sufficient to cover costs for the vegetative roof.

3. c. State the difference in the proposed facilities' cost resulting from the use of the vegetative roofs instead of standard roofs.

Answer: The engineer's Opinion of Probable Construction Cost indicated a standard roof costs $8/SF or about $130,000. A vegetative roof costs $19/SF or about $305,000 for Taylor Mill. Therefore, the estimated cost difference for a vegetative roof is $175,000.

3. d. For each structure in which a vegetative roof is proposed, state the additional cost of the structure that is attributable to structural features necessary to support the additional weight of a vegetative roof.

Answer: The additional cost for the roof structure to support a vegetative roof is not available from the engineer. To obtain this information would require further analysis from the structural engineer. The engineer would be entitled to request additional compensation to complete this work.

3. e.(1) State whether it would be feasible and desirable to expand the proposed detention basin to compensate for the use of a standard roof. Explain.

Answer: A larger storm water detention basin is feasible to accommodate runoff from a standard roof, although the 100-year floodplain does restrict usable areas of the site. It is estimated that building heating requirements will be reduced by about 10% because of the vegetative roof, which equates to roughly $3,100 a year. Although the District estimated an unusually long payback period of 66 years, it elected to use a vegetative roof because it is promoted as being Green Infrastructure under the Drinking Water State Revolving Fund Green Project Reserve Guidance. This component of the project counts toward the State's Green Project Reserve initiative for loan recipients.

3. e.(2). If it is feasible to expand the proposed detention basin to compensate for the use of a standard roof, state the cost of such expansion.

Answer: The estimated construction cost for enlarging the detention basin is $5,000.

4. Describe the difference, if any, in the operation of post-filtration granular activated carbon ("GAC") adsorption facilities in the winter periods and summer periods.

Answer: The operation of vessels may be different in the winter months if the plant continues to operate 5 days a week in the winter as compared to 7 days a week in the summer, as is the current practice. The decision to continue to suspend weekend operations during the winter months has not been made at this time. It is anticipated the carbon in the vessels would be exchanged in the months of March through November.

5. Describe the effect of Northern District's compliance with the Stage 2 Disinfectants and Disinfection Byproduct ("Stage 2 D/DBP") Rule if two or more GAC vessels are simultaneously out-of-service.

   Answer: If two or more GAC vessels are out of service at Taylor Mill Treatment Plant, the District can utilize blending of water produced at Fort Thomas Treatment Plant with water produced at Taylor Mill Treatment Plant to meet the Stage 2 Disinfectants and Disinfection Byproducts Rule and increase the hydraulic loading rate on the in-service vessels and replace the carbon at Taylor Mill Treatment Plant at an increased rate to compensate for a reduced Empty Bed Contact Time (design is 20 minutes at 12 MGD with all 14 vessels in service).

6. a. State whether Northern District has acquired additional real estate for the proposed project.

   Answer: The District acquired 2 properties adjacent to the Taylor Mill Treatment Plant in August 2009. These properties were not required to build the proposed structures, but doing so eliminated the cost for relocating an existing 36 inch transmission line.

6. b. If Northern District has acquired additional real estate for the proposed facilities, state the amount of real estate acquired, the date of the acquisition, and its purchase cost.

   Answer: The District paid $130,000 for 0.51 acres at 634 Grand Avenue on August 20, 2009 and $155,000 for 1.45 acres at 638 Grand Avenue on August 20, 2009.

6. c. State the cost to prepare any additional real estate acquired for the proposed facilities. Describe the nature of the site preparation.

   Answer: The District demolished the houses at 634 Grand Avenue and 638 Grand Avenue for a cost of $12,539.

6. d. State whether all of the acquisition and site preparation costs associated with any additional real estate acquired for the proposed facilities is included in the estimated project cost of $35 million.

   Answer: The $285,000 to purchase the properties was not charged to the project. The $12,539 site preparation was charged to the project. The estimated project cost was lowered to $28,350,000 in the revised Exhibit D submitted May 19, 2011.

6. e. If all acquisition and site preparation costs associated with any additional real estate acquired for the proposed facilities is not included in the estimated project cost of $35 million, identify the source of funding for these costs.

   Answer: The purchase cost of $285,000 was paid for by the District's Operating and Maintenance budget account number 303-0002-000. The estimated project cost was lowered to $28,350,000 in the revised Exhibit D submitted May 19, 2011.

7. Refer to Malcolm Pirnie, Inc., Taylor Mill Advanced Treatment Improvements Basis of Design (Mar. 2009) at 10-1. Provide the permits listed below. For each permit that has not been issued, provide the request of application for such permit and state the current status of the request for the permit.

7. a. Encroachment Permit (Kentucky Transportation Cabinet):

   Answer: A Kentucky Transportation Cabinet Encroachment permit is not required.

7. b. Grading, Erosion Control and/or Land Disturbance Permit (Sanitation District No. 1 of Northern Kentucky);

   Answer: The Grading, Erosion Control and/or Land Disturbance Permit from Sanitation District No. 1 is approved but is not transmitted until start of construction. The Land Disturbance Permit is number LDP-0515-1210.

The application is attached as Exhibit 7.b along with the Stream Crossing Application and Permit.

7. c. Local Road/Street Encroachment Permit;

Answer: A local street encroachment permit is not required.

7. d. Kentucky Housing and Building Enforcement Review;

Answer: The Northern Kentucky Area Planning Commission approved the 5 building permits associated with the project in March 2011 (Chemical Building and Tunnel Modifications, GAC Feed Pump Station, Preliminary Treatment Building and GAC Building, Filter Building and Tunnel Modifications, and Retaining Walls). The permits will be released upon the District's payment of $5,165.44 for the balance of fees for inspection. The application is attached as Exhibit 7.d.

7. e. Local Building Permit; and

Answer: The local building permit is addressed in 7.d. above.

7. f. Plumbing Permit.

Answer: The Plumbing permit has been applied for and the contractor will pay the $25 fee and pick up the permit. The application is attached as Exhibit 7.f.

8. a. State the length of time that the Taylor Mill Water Treatment Plant will be out of service during the proposed construction.

Answer: The contractor is permitted to take the plant out of service for up to 30 consecutive days between October 16th and April 30th. The total number of outages during the 33-month construction schedule will be determined by the contractor's sequencing of the work. The District does not have this information from the contractor.

8. b. Describe how Northern District expects to meet demand during service interruptions.

Answer: The District restricted the plant outages to winter months when the water conveyed from the Fort Thomas Treatment Plant to the Taylor Mill Treatment Plant is adequate to satisfy the entire demand. Water from Fort Thomas is pumped to the system via 3 pumps at Taylor Mill. None of these 3 pumps can be taken out of service while the plant is out of service.

9. Refer to Northern District's Application, Exhibit D.

9. a. Provide a breakdown of the projects included in the miscellaneous costs and contingencies of $4,431,720.

Answer: The miscellaneous and contingencies costs were revised following the bid opening per the information submitted on May 15, 2011. The revised cost is $2,451,150.00. Here is a breakdown of the costs:

Erosion Remediation Engineering	$	9,700.00
Erosion Remediation Bid	$	139,612.50
SCADA Computers & Software	$	35,000.00
Demolish Houses Bid	$	12,539.00
SD1 Land Disturbance Permit Fees	$	1,007.50
Ground Penetrating Radar Service	$	1,050.00
Building Permit Fees	$	8,153.44
Advertising Bids in Papers	$	2,724.06
Contingency (<10%)		$2,241,363.50
TOTAL		$2,451,150.00

9. b. Provide all correspondence, internal memoranda, notes, and electronic mail messages in which the need for these costs was discussed.

Answer: Documents attached as Exhibit 9b.

9. c. State whether Northern District intends to request bids on all miscellaneous costs and contingencies. If no, identify each component for which no bids will be requested and explain why no bids will be requested.

Answer: The Erosion Remediation project was already bid and approved by the District's Board of Commissions for $139,612.50. The demolition of two existing structures was completed for $12,539.00. The 2 proposed SCADA computers will be purchased from a vendor and the 2 software licenses will be purchased from a Wonderware distributor; these items are expected to be under the $20,000 threshold for bidding so quotations will be solicited. The miscellaneous costs to date are noted in item 9a above and were not subject to bidding. The project contingency is expected to be used for unidentified costs that typically arise during construction. The District will attempt to negotiate change orders with the contractor and engineering amendments with the engineering firms as needed to cover items that are not currently known but are expected to occur with any construction project.

10. Refer to Northern District's Application, Exhibit D. For each listed component of "Additional Costs and O&M," provide a breakdown of the component and show all calculations used to determine the additional O&M annual cost as presented.

Power Calculations:

GAC Feed Pumps	1,291,925 kWh/yr x $0.05/kWh =	$64,596
Lighting	175,000 kWh/yr x $0.05/kWh =	$ 8,750
Other equipment & instruments	=	$ 1,654
Total Estimated Annual Power		$75,000

Labor Estimate: Assumed equivalent of 1 additional staff member for operations and maintenance at $70,000 a year

Maintenance Calculations:

GAC 21 vessels x 40,000 lb/vessel x \$1.20/lb = \$1,008,000
Building/Equipment Maintenance, 2% of construction = \$ 455,800
Services (i.e. Substation Inspection & Repairs) = \$ 36,200
Total Estimated Annual Maintenance \$1,500,000

TOTAL ESTIMATED ANNUAL O&M \$1,645,000

11. State whether the two power generators included in the proposed construction are also intended to power the Taylor Mill Water Treatment Plant's raw water intake in the event of power outage.

Answer: The two proposed power generators at the Taylor Mill Treatment Plant are not sized to provide emergency power to the raw water intake. The raw water intake is located approximately one mile away from the treatment plant. A separate project for \$4,100,000 is planned for year 2014 (see PSC reference number 176) to install power generators at the Licking River Pump Station. This is the intake and pumping station that supplies raw water to the Taylor Mill Treatment Plant.

12. Describe the exercise plan that Northern District will use for the proposed power generators.

Answer: The generators will be exercised in accordance with the District's Generator Maintenance & Reliability Standard Operating Guidelines which states the following:

- All generators will be tested and ran under load for a 2 to 4 hour period each quarter.
- All generators will be ran off load for reliability and startup capabilities for a 15 to 20 minute period.
- Semi-annually the District has a contractor visit to service the generators for oil changes, filter changes and alarm signals.

13. Describe Northern District's residual management program for conventional/GAC processes. This description shall identify and describe all required permits necessary for the program's operation.

Answer: Residuals are generated during the drinking water treatment process. Residuals are composed mainly of the silt and sediment naturally present in the river water being treated. In addition, as a result of the flocculation and sedimentation process, the residuals also contain trace amount of water treatment chemicals, especially coagulants that are used in the treatment process. All water treatment chemicals used in the process are certified to comply with ANSI/NSF Standards 60 and 61 for use in potable water treatment.

At the Taylor Mill Treatment Plant, residuals are collected from two stages of the water treatment process: sedimentation and spent filter backwash water. Solids from the sedimentation process are collected through a sludge drain system and pumped to the sludge holding tanks located behind the sludge press building. Solids are allowed to concentrate in these tanks. Solids from the bottom of the tanks are pumped to a belt filter press and dewatered for off-site disposal through a beneficial reuse program. The liquid is decanted from the sludge tanks to the spent backwash tank through a series of decant valves. The backwash tank also receives spent filter backwash water from the conventional filters and sludge press filtrate water. This combined waste stream is then treated through lamella plate settling units to remove solids so that the waste water can then be discharged to Banklick Creek under KPDES Permit KYG640158, AI ID: 2485. The solids from the lamella plate settlers are returned to the sludge holding tanks for treatment though the belt filter press. The residual solids cake from the belt filter press is collected in dumpsters and disposed of off-site. The residual solids are permitted under Solid Waste Permit # 059-00019 and the waste treatment process is classified as a "Special Waste Beneficial Reuse – Registered Permit-by-Rule". The waste contractor is Waste Resource Management, Inc., located in Mason, Ohio.

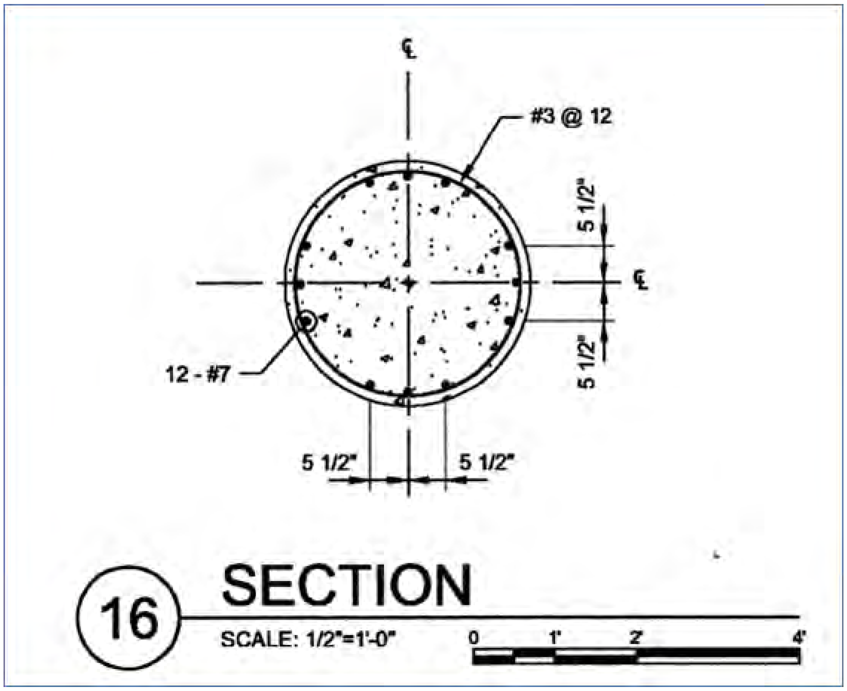
The GAC process will not create a residual. The vessel backwash water, GAC truck loading, and contactor-to-waste operation will produce water with tiny carbon particles ("fines"), but this water will be collected in the equalization basin and returned to the head of the treatment process.

14. Refer to Plan Sheet M-09-202. Describe the need to locate a one-inch sodium hypochlorite feed line in the proposed rapid mix area in light of the Stage 2 D/DBP Rule.

Answer: The purpose of the one inch sodium hypochlorite feed line to the proposed rapid mix is designed for operational flexibility if preoxidation would ever be necessary. It would not be used under normal operating conditions since chlorinating that early in the treatment process would cause an increase in disinfection by-products. However, there are situations when preoxidation with sodium hypochlorite could be employed such as high levels of bacteriological contamination in the raw water source from floods, combined sewer overflows or sewer system malfunctions; taste and odor events common during hot, dry summers due to increased algae growth; and oxidation of iron and manganese if there are abnormally high levels of these metals in the raw water source.

15. Refer to Plan Sheet S-06-301, Section 16. Section 16 shows a three-foot diameter drilled pier. The #7 steel reinforcement is distributed at four locations along the vertical and horizontal axes in a formation of three rebars spaced at five and one-half inches and totaling 12 rebars at a cumulative perimeter length of 44 inches. In the same cross-section, there also appear areas without any reinforcement for a cumulative perimeter length of 56 inches in the diagonal directions between the reinforced vertical and horizontal axes. Explain the rebar spacing in the cross-section.

Answer: A square column as shown in Sections 3 and 13 on sheet S-06-302 is sitting on the circular column shown in Section 16. The structural engineer designed the elements so that some of the rebar from the circular column would continue to the square column.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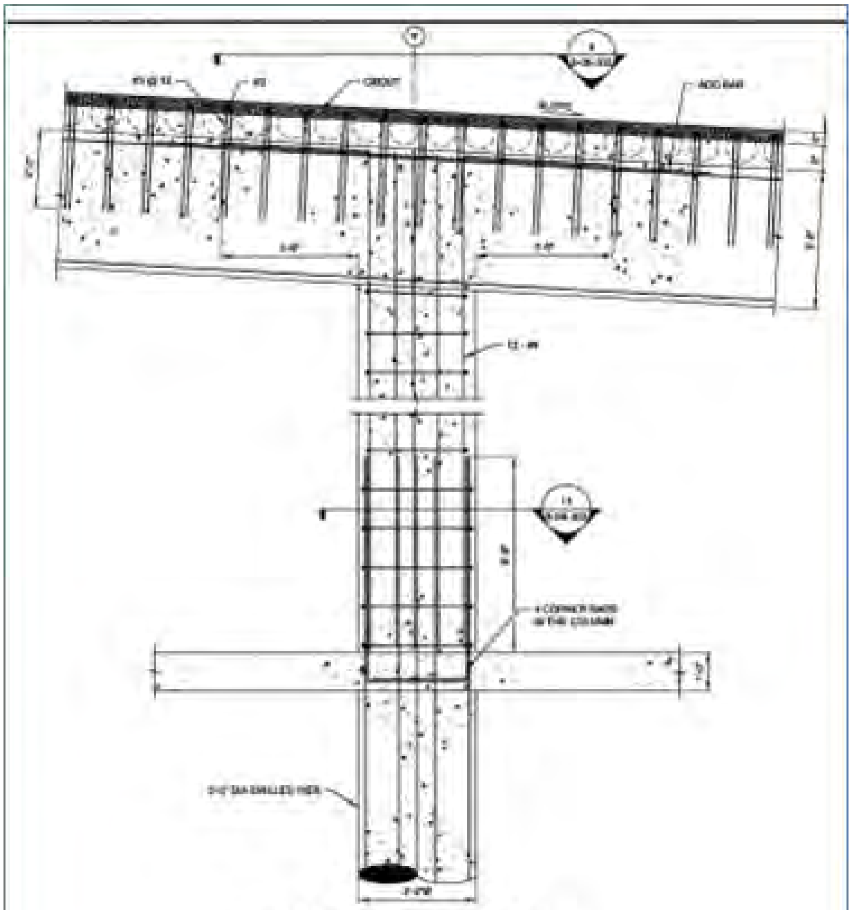
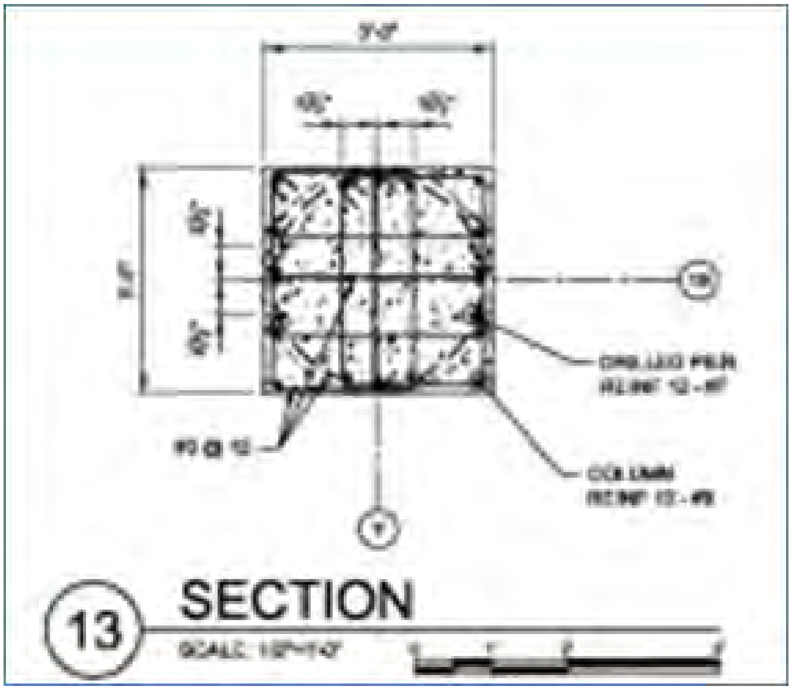


3 TYPICAL SECTION



16. List and describe each existing system redundancy in the Taylor Mill Water Treatment Plant. Explain how each redundancy lessens the risk of service disruption or enhances service reliability.

    Answer: The existing system redundancy in the Taylor Mill Treatment Plant is described below:

    a. Filters – There are 8 existing filters. The filtration capacity is more than the plant's rated 10 MGD capacity. However, it is good practice to have extra filtration capacity so that a clean, stand-by filter can be ready for service as a filter currently running becomes due for backwashing. This practice provides for a more even plant flow rate, which leads to a more consistent finished water quality. This also provides for the staged maintenance of filters as necessary without a significant reduction in plant treatment capacity while the work is in progress.
    b. Chemical Feeders – Each chemical feed system has one spare chemical feed pump. The spare feed pump can be configured to feed to any of the chemical application points through the proper

use of a series of valves. This redundancy allows for plant operation to continue when a chemical feed pump fails because the spare pump would be placed into service while the malfunctioning feed pump is repaired without any interruption or reduction to the amount of water the treatment plant is capable of producing during the malfunction.

c. Ultraviolet Disinfection (UV) – When the UV system was being designed, the Kentucky Division of Water required complete UV system redundancy. This allows for a UV unit to be in service while maintenance is performed on the other unit.
d. High Service Pumps – There is redundancy in the high service pumping. This allows for continued pumping of treated water out of the Taylor Mill Treatment Plant to meet a wide range of system demands that can vary considerably throughout the year. It also allows for continued pumping when a high service pump requires maintenance.

17. List and describe system redundancy in the proposed facilities. Explain how each redundancy will lessen the risk of service disruption or enhance service reliability.

Answer: The GAC vessels provide 20 minutes of Empty Bed Contact Time at the plant's rated capacity of 10 MGD with all 14 vessels in service. There are no redundant GAC vessels, and the District does not see a risk in this decision. Although the Empty Bed Contact Time would be reduced if units were taken out of service, the carbon replacement frequency could be increased to produce comparable effluent quality. The District provided two methods of backwashing the GAC vessels – one through a pump using GAC-treated water as the supply and one through a connection to a transmission main along Grand Avenue. The connection to the transmission system will serve as a backup in the event of a backwash pump failure (instead of having a second backwash pump) or for times when the process is not producing GAC treated water to serve as a supply for backwashing the vessels. For the Preliminary Treatment Building, the District plans 1 redundant rapid mix basin, 1 redundant flocculation basin, and 1 redundant sedimentation basin to comply with KDOW requirements.

18. For each of Northern District's water treatment plants, state Northern District's estimated costs for additional sampling and testing required to comply with the Stage 2 D/DBP Rule. Show all calculations and state all assumptions used to develop this estimate.

Answer: The District's samples will be reduced from 12 quarterly monitoring sites in Stage 1 to 8 sites in Stage 2 for compliance. The DBP analyses cost about $225 per sample. The total number of samples per year for Stage 1 is 48 for a total annual cost of approximately $10,800. The total number of samples per year for Stage 2 compliance is 32 for a total annual cost of approximately $7,200. The difference will be $3,600 per year less for Stage 2 than for Stage 1 sampling. Samples for Total Organic Carbon will be collected periodically on the individual contactor and pressure vessel effluent to determine the performance of the carbon. This analysis costs around $77 per sample. The frequency of this sampling has yet to be determined.

19. Refer to Malcolm Pirnie, Inc., Taylor Mill Advanced Treatment Improvements Basis of Design (Mar. 2009) at 4-7. Provide a copy of the geotechnical consultant's report and recommendations.

Answer: The geotechnical report is attached as Exhibit 19.

AFFIDAVIT

COMMONWEALTH OF KENTUCKY

COUNTY OF KENTON

Affiant, Amy Kramer, after being first sworn, deposes and says that she is authorized to submit this Response on behalf of Northern Kentucky Water District, and that the information contained in the Response is true and accurate to the best of her knowledge, information and belief, after a reasonable inquiry, and as to those matters that are based on information provided to her, she believes to be true and correct.

Amy Kramer

Amy Kramer, P.E.

This instrument was produced, signed, acknowledged and declared by Amy Kramer to be her act and deed the 8TH day of JULY, 2011.

Colleen Kelly Medert

Notary Public

My Commission expires: May 6, 2013

COLLEEN KELLY MEDERT
NOTARY PUBLIC
STATE AT LARGE, KY.
My Commission Expires 5/6/13

EXHIBIT 7b
LAND DISTURBANCE PERMIT APPLICATION
AND STREAM CROSSING PERMIT

LAND DISTURBANCE PERMIT APPLICATION FORM

Note: The application form and supporting documentation must be completed in its entirety and delivered to **Sanitation District No. 1 – Storm Water Department, 1045 Eaton Drive, Ft. Wright, KY 41017** to begin the review process. The omission of required items may be cause for rejection of the submittal without review.

Project Name:	Taylor Mill Treatment Plant Advanced Treatment Improvements		
Project Address:	608 Grand Avenue, Taylor Mill, KY 41015		
Subdivision Name/Lot No.:	N/A		
Parcel ID From County PVA:	056-20-02-027.02		
District Permit Previously Issued: ☐ Yes ☒ No		If Yes, Previous Permit No.:	
Permit Previously Issued From Other Agency(ies): ☒ Yes ☐ No		If Yes, Describe:	KPDES #KYG640000
Total Area Of Project Site (Acres):	6.60	Total Impervious Area For Property (Square Feet):	86.654
Total Area of Land Disturbing Activities (Acres):	4.75		

Property Owner:	Northern Kentucky Water District	Contact Person:	Amy Kramer
Address:	2835 Crescent Springs Road, P.O. Box 18640, Erlanger, KY 41018		
Telephone:	859-426-2734	Fax:	859-578-7893
E-mail:	akramer@nkywater.org		
Developer:	N/A	Contact Person:	
Address:			
Telephone:		Fax:	
E-mail:			
Designer:	Strand Associates, Inc.®	Contact Person:	Christopher S. Dent
Address:	1525 Bull Lea Road, Suite 100, Lexington, KY 40511		
Telephone:	859-225-8500	Fax:	859-225-8501
E-mail:	chris.dent@strand.com		

Checklist: The purpose of this checklist is to expedite and facilitate the review process. This checklist gives the minimum requirements needed for District review. All items shall be checked as included or marked as N/A. If an item is marked as N/A, provide an explanation in the section entitled Comments below.

X	Project Information
X	Location Map
N/A	Property Boundary and Adjacent Property Owners
X	Clearing Limits
X	Improvement Drawings (with Scale Not Smaller Than 1 Inch Equals 100 Feet)
X	Existing and Proposed Contours and Location And Description Of Benchmark Used
X	Existing and Proposed Public And Private Rights-Of-Ways And Streets
X	Location Of Proposed Storm Water and Water Resource Facilities Including Manholes, Pump Stations, Catch Basins, Inlets, And Headwalls.
X	Detention/Retention Facilities Clearly Identified With the Maximum Volume Capcities Labeled And Detailed Drawings Of All Overflow Facilities
X	Storm Water Facilities (Inlets, Catch Basins, Junction Boxes, Headwalls, Manholes, Etc.) Numbered And Corresponding To The Profiles Of Storm Sewers And Culverts
N/A	Maintenance Responsibility For Detention/Retention Facilities And Maintenance Activities Noted On The Improvement Drawings
X	Profiles Of All Proposed Storm Water Sewers, Culverts, And Facilities (Including Percent Grade, Pipe Diameters, Material, And Lengths, And Invert Elevations). Profiles Shall Also Show All Existing And

X	Proposed Public Utility (Water, Storm And Sanitary Sewer) Crossings, And All Existing Private Utility (Gas, Electric, Telephone, Etc.) Crossings.		
X	Hydraulic Grade Lines For The 10-Year And 25-Year Design Storms		
X	Outlet Velocities At All Headwalls And Outlets Of Storm Sewers And Culverts		
N/A	Location and Identification Of Any Drainage Facility or Natural Feature On The Site or Within 100 Feet Of The Project Boundary That Has Or Could Have An Impact On Drainage or Sediment Control		
X	Existing Utilities, Sewers, and Storm Drainage Structures And Facilities. Also Connections To Existing Facilities Shown And Labeled.		
N/A	Adjoining Storm Drainage Structures And Facilities To Show Continuity In The Overall Storm Water Drainage System, If This Project Is One Phase Of A Multi-Phase Development		
N/A	Proposed Easements		
X	Erosion Prevention And Sediment Control Plan		
X	Location, Details, And Standard Drawings for BMPs (I.E. Stabilized Construction Entrances, Perimeter Controls, Inlet and Outlet Protection For Storm Sewers And Culverts, Stream Crossings)		
X	Computations To Support all Drainage and Sediment Control Designs In A Form Meeting The District's Requirements And Sealed Be The Kentucky Licensed Professional Engineer Preparing The Designs		
N/A	Electronic Copy Of Submittal (If Computer Generated)		
	Required Fees (Compute on The Right	Plan Review Fee:	= $500.00
		Inspection Fee: ($50.00 Per Acre Of Land Disturbing Activities, Not To Exceed $500.00)	250.00
		Total	$750.00
	Comments: (Special Notes That May Pertain To Project) Attach Additional Sheet If Necessary: ☐ Yes ☒ No 1) Maintenance of Detention/Retention Facilities is the responsibility of the Owner. 2) Banklick Creek north of property and no improvements within 100 feet of Banklick Creek.		

Certifications: The following certifications are required.

Owner/Person Financially Responsible Certification: "I hereby certify that all land disturbing construction and associated activity pertaining to this permit application shall be accomplished pursuant to the approved plans. The information submitted with the applications is, to the best of my knowledge and belief, true, accurate, and complete.

Printed Name of Owner/Person Financially Responsible: ______________________________

Signature: ______________________________ Date: ______________________________

Right of Entry Certification for Inspection: "I hereby grant authorization to Sanitation District No. 1 and/or designated representatives the right of access to the site at all times for the purpose of site inspections during the period of construction and to perform maintenance inspections following the completion of the land disturbing activity."

Printed Name of Owner/Person Financially Responsible: ______________________________

Signature: ______________________________ Date: ______________________________

Designer Certification: "I hereby certify to the best of my knowledge and belief that the measures in this plan are designed to control erosion, retain sediment on the site, and manage storm water in a manner that is in compliance with the requirements contained in the Sanitation District No. 1 rules and regulations."

Printed Name of Engineer: Christopher S. Dent

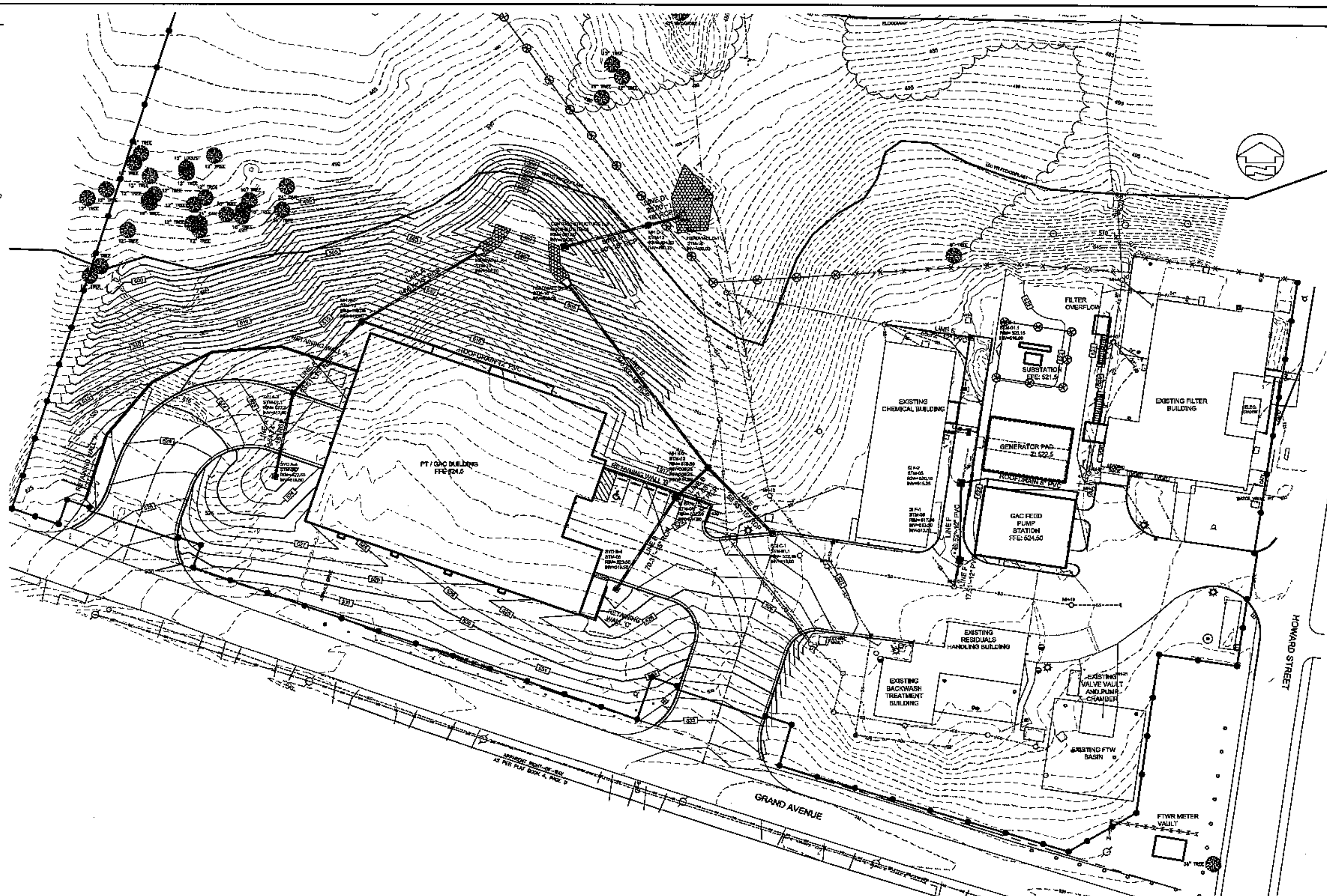
Kentucky PE Number: 26087

Date: ______________________________

(Stamp and Signature)

GENERAL NOTES:

1. CONTRACTOR TO REFER TO SHEET C-01-101 FOR COORDINATES AND ELEVATIONS THROUGHOUT THE SITE.
2. CONTRACTOR TO REFER TO SHEET C-01-105 FOR EROSION CONTROLS TO BE INSTALLED PRIOR TO LAND DISTURBING ACTIVITIES.
3. SITE PREPARATION WILL REQUIRE REMOVAL OF ALL VEGETATION, SURFACE ORGANIC SOILS, AND ANY OTHER SURFACE DELETERIOUS MATERIALS.
4. THE CONTRACTOR IS TO VERIFY THE EXACT LOCATION OF ALL EXISTING UTILITIES AND BENCHMARKS. TAKE CARE TO PROTECT UTILITIES THAT ARE TO REMAIN. REPAIR ANY DAMAGE ACCORDING TO LOCAL STANDARDS AND AT THE CONTRACTOR'S EXPENSE. COORDINATE ALL CONSTRUCTION WITH THE APPROPRIATE UTILITY COMPANY.
5. PROPOSED CONTOUR LINES AND SPOT ELEVATIONS ARE THE RESULT OF AN ENGINEERED GRADING DESIGN AND REFLECT A PLANNED INTENT WITH REGARD TO DRAINAGE AND MOVEMENT OF MATERIALS. SHOULD THE CONTRACTOR HAVE ANY QUESTIONS OF THE INTENT OR ANY PROBLEM WITH THE CONTINUITY OF GRADES, THE ENGINEER SHALL BE CONTACTED IMMEDIATELY.
6. THE CONTRACTOR SHALL CALL KENTUCKY ONE CALL (1-800-752-6007) 72 HOURS PRIOR TO PROCEEDING WITH ANY EXCAVATION.
7. ALL CUT AND FILL SLOPES SHALL BE 3.5 HORIZONTAL TO 1 VERTICAL OR FLATTER UNLESS OTHERWISE INDICATED ON THE PLANS.
8. POSITIVE DRAINAGE SHALL BE ESTABLISHED AS THE FIRST ORDER OF WORK AND SHALL BE MAINTAINED AT ALL TIMES DURING AND AFTER CONSTRUCTION. SOIL SOFTENED BY PERCHED WATER IN FOUNDATION AND PAVEMENT AREAS MUST BE UNDERCUT AND REPLACED WITH SUITABLE FILL MATERIALS APPROVED BY THE GEOTECHNICAL ENGINEER. GROUNDWATER INFILTRATION INTO EXCAVATIONS SHOULD BE EXPECTED, AND THE WATER SHALL BE REMOVED USING GRAVITY DRAINAGE OR PUMPING.



0 1/2 1

DRAWING IS NOT TO SCALE IF THIS DOES NOT MEASURE 1 INCH.

MALCOLM PIRNIE

REVISIONS

NO.	BY	DATE	REMARKS

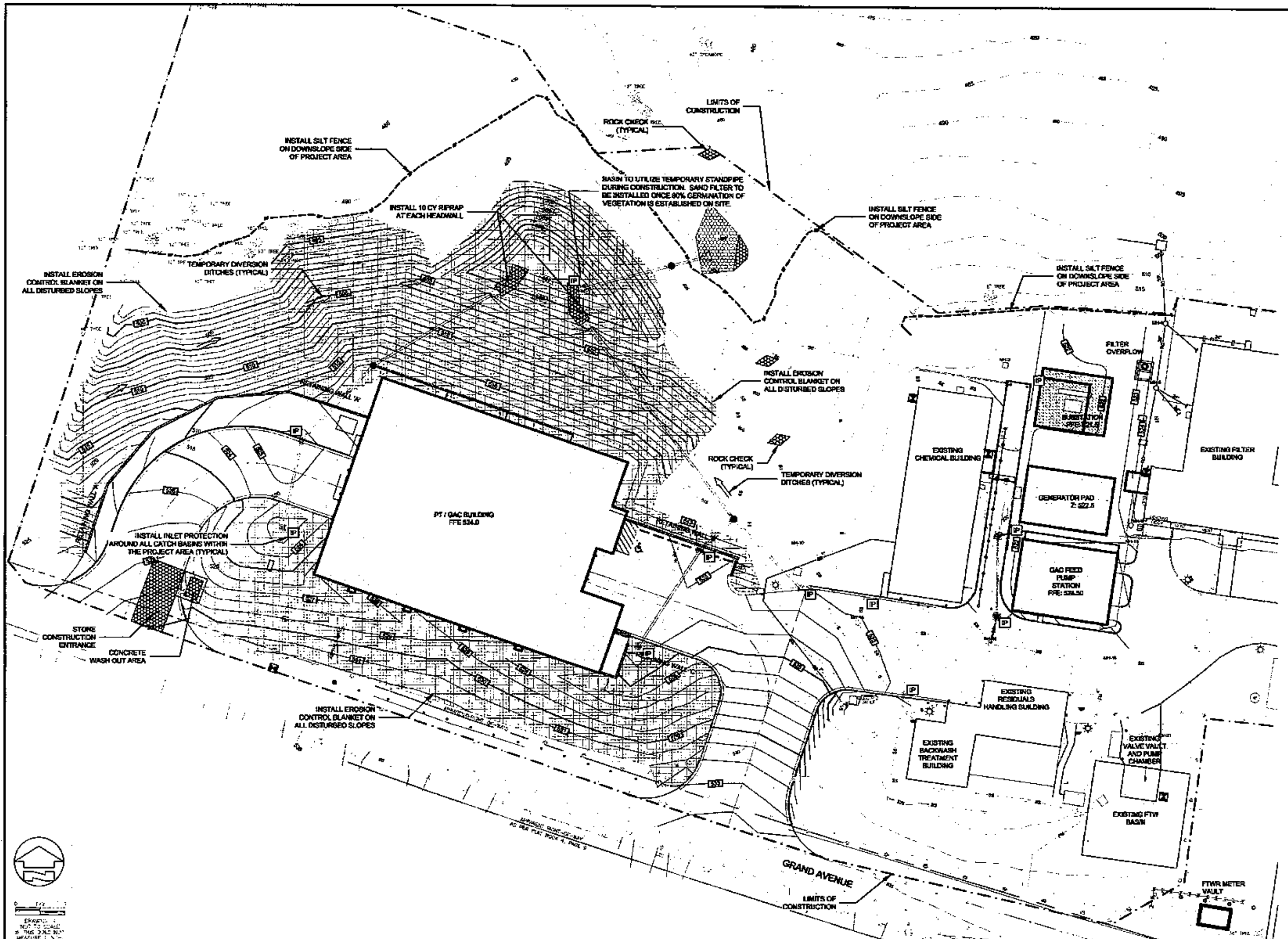
DES ASC
DWN ASC
CKD HHH

NORTHERN KENTUCKY WATER DISTRICT
TAYLOR MILL WATER TREATMENT PLANT
ADVANCED TREATMENT IMPROVEMENTS

CIVIL
SITE GRADING PLAN

SCALE: 1" = 30'

ISSUED STATUS: 100% SUBMITTAL
DATE OCTOBER, 2010
SHEET C-01-102
CAD REF. NO. 3789-C-01-102



SEDIMENT AND EROSION CONTROL NOTES:

IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTROL EROSION FROM THIS SITE DURING ITS PHYSICAL ALTERATION. THE EROSION CONTROL PLAN SEEKS TO PROVIDE SOME DIRECTION IN THE MANNER IN WHICH THE OBJECTIVE TO CONTROL EROSION CAN BE ACCOMPLISHED. IT IS NOT THE INTENT OF ENGINEER TO LIMIT THE CONTRACTOR IN THE MANNER AND TECHNIQUES TO CONTROL EROSION. A RECOMMENDED RESOURCE FOR CONTRACTOR'S WORK IS "STORM WATER MANAGEMENT FOR CONSTRUCTION ACTIVITIES-DEVELOPING POLLUTION PREVENTION PLANS AND BEST MANAGEMENT PRACTICES" PUBLISHED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.

ANY PROPOSED BMP CHANGE SHOULD BE COORDINATED WITH THE OWNER'S REPRESENTATIVE AND NOTED ON THE BEST MANAGEMENT PRACTICES (BMP) PLAN, LOCATED ON SITE AT ALL TIMES DURING CONSTRUCTION.

THE CONTRACTOR IS RESPONSIBLE FOR DEVELOPMENT OF AND COMPLIANCE WITH A STORMWATER POLLUTION PREVENTION PLAN (SWPPP) SUBMITTED AND ACCEPTED BY THE SD1 FOR THIS PROJECT THROUGH ALL STAGES OF CONSTRUCTION.

ALL STRUCTURAL BMPS SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE CURRENT SD1 STORMWATER MANUAL.

THE FOLLOWING IS A LIST IN SEQUENCE OF CONSTRUCTION ACTIVITIES TO CONTROL SOIL EROSION FOR THE PROJECT.

1) CONTRACTOR SHALL SUBMIT A KENTUCKY DIVISION OF WATER (KYDOW) - NOTICE OF INTENT TO THE KYDOW, UPON SD1'S ACCEPTANCE OF THE CONTRACTOR'S SWPPP.

2) CONTRACTOR SHALL INSTALL STONE CONSTRUCTION ENTRANCE SURFACE WHERE CONSTRUCTION TRAFFIC ENTERS AND EXITS THE SITE. CONSTRUCTION ENTRANCE SHALL BE A MINIMUM 20' WIDE, 40' LONG, WITH 12" MINIMUM THICKNESS, OR AS NOTED ON DRAWING, AND USE NO. 2 STONE WITH GEOTEXTILE FABRIC BELOW THE STONE. THE CONTRACTOR IS RESPONSIBLE FOR KEEPING STREETS FREE FROM MUD, DIRT, DEBRIS, AND ROCK. DUST SHALL BE KEPT TO A MINIMUM BY UTILIZING SPRINKLING, CALCIUM CHLORIDE, VEGETATIVE COVER, SPRAY ON ADHESIVES OR OTHER APPROVED METHODS.

3) INSTALL SILT FENCE AS SHOWN ON THE CONSTRUCTION DRAWINGS OR REQUIRED BY CONTRACTOR'S STAGING OF CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR PLACEMENT OF ANY ADDITIONAL SILT FENCE, AT NO ADDITIONAL COST, TO PROTECT SOIL STOCKPILES AND STAGING AREAS.

4) CLEAR AND GRUB THE SITE AND DISPOSE OF ALL DEBRIS PROPERLY. IF AN AREA THAT HAS BEEN DISTURBED IS TO BE INACTIVE FOR MORE THAN 14 DAYS THE CONTRACTOR SHALL SUPPLY STABILIZATION BY MEANS OF TEMPORARY SEEDING AND MULCHING, SODDING, COVERING OR OTHER EQUIVALENT EROSION CONTROL MEASURES AS SOON AS PRACTICAL. IN NO CASE SHALL AN AREA REMAIN UNTREATED FOR MORE THAN 7 DAYS AFTER CONSTRUCTION ACTIVITY HAS TEMPORARILY OR PERMANENTLY CEASED. FOR TEMPORARY SEEDING THE CONTRACTOR SHALL UTILIZE A FAST GROWING SEED OF EITHER OATS, ANNUAL RYE GRASS, WHEAT OR RYE DEPENDING ON TIME OF YEAR.

5) MAINTAIN ALL FILTERS AND TRAPS DURING CONSTRUCTION TO PREVENT ANY BLOCKAGES FROM ACCUMULATED SEDIMENT. AFTER EVERY RAIN IN EXCESS OF HALF AN INCH, SILT CONTROL DEVICES ARE TO BE INSPECTED, CLEANED AND REPAIRED IF NECESSARY. SILT FENCE MUST BE CLEANED IF SILT BUILDUP REACHES 1/3 OF THE SILT FENCE HEIGHT. SILT TRAPS SHALL BE CLEANED WHEN SILT DEPOSITS REACH 1/2 OF TRAP CAPACITY. ADDITIONAL SEEDING OR SILT FENCE MAY BE REQUIRED DURING CONSTRUCTION AS SPECIFIED BY THE OWNER'S REPRESENTATIVE.

6) WHEN DISTURBED AREAS ARE AT FINAL GRADE AND ALL ACTIVITY IN THESE AREAS IS COMPLETE, EROSION CONTROL MATS AND PERMANENT VEGETATION SHALL BE PROVIDED.

7) CONTRACTOR SHALL MAINTAIN ALL TEMPORARY EROSION CONTROL MEASURES THROUGHOUT THE CONSTRUCTION PHASE OF THIS PROJECT AND REMOVE ALL TEMPORARY EROSION AND SEDIMENT CONTROLS ONLY WHEN THERE IS 80% COVERAGE OF ESTABLISHED GERMINATED GROUND COVER TO PREVENT FURTHER EROSION. ONCE CONSTRUCTION IS COMPLETE, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT SILT HAS BEEN REMOVED FROM ALL PERMANENT WATER QUALITY FILTERS AND STORM SEWER FACILITIES.

8) UPON COMPLETION OF CONSTRUCTION ACTIVITIES, VEGETATION ESTABLISHED, AND AFTER OWNER'S ACCEPTANCE, CONTRACTOR SHALL SUBMIT KYDOW - NOTICE OF TERMINATION.

MALCOLM PIRNIE

STRAND ASSOCIATES, INC. ENGINEERS

STATE OF KENTUCKY CHRISTOPHER DENT 26087 LICENSED PROFESSIONAL ENGINEER

REVISIONS

NO.	BY	DATE	REMARKS

DES CJR
DWN CSD
CKD MAW

NORTHERN KENTUCKY WATER DISTRICT
TAYLOR MILL WATER TREATMENT PLANT

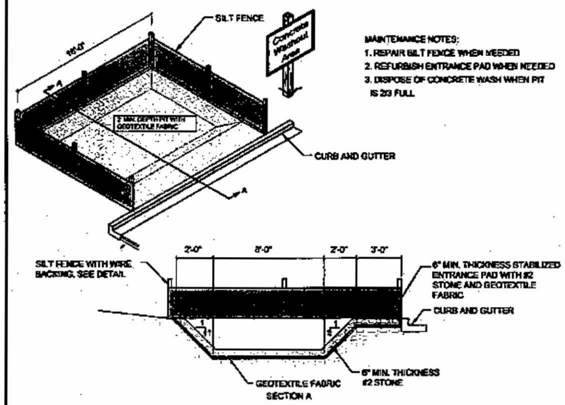
ADVANCED TREATMENT IMPROVEMENTS

CIVIL

EROSION CONTROL PLAN

SCALE: 1" = 30'

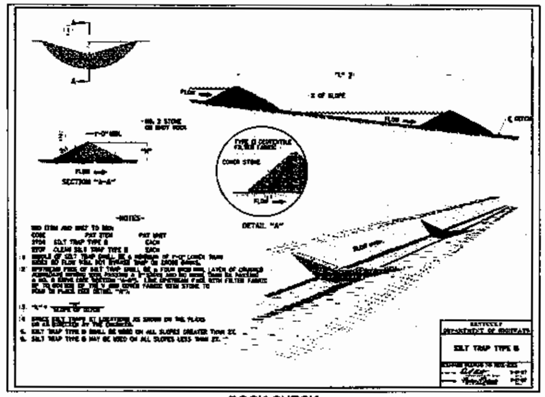
ISSUED STATUS: 100% SUBMITTAL
DATE OCTOBER, 2010
SHEET C-01-105
CAD REF. NO. STRAND-C-01-105



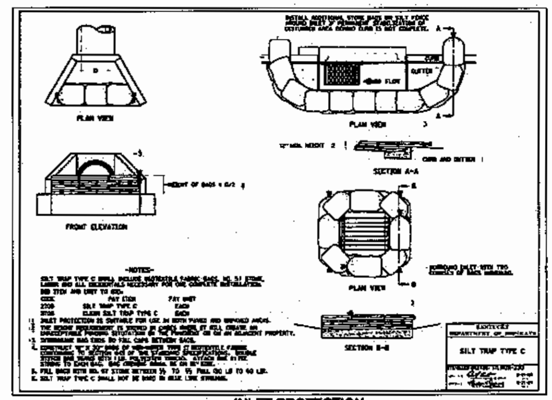
MAINTENANCE NOTES:

1. REPAIR SILT FENCE WHEN NEEDED
2. REFURBISH ENTRANCE PAD WHEN NEEDED
3. DISPOSE OF CONCRETE WASH WHEN PIT IS 2/3 FULL

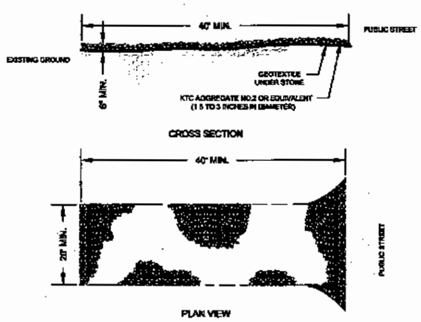
CONCRETE WASHOUT AREA
N.T.S.



ROCK CHECK
N.T.S.



INLET PROTECTION
N.T.S.



CONSTRUCTION ENTRANCE NOTES:

1. A STABILIZED ENTRANCE PAD OF CRUSHED STONE SHALL BE LOCATED WHERE TRAFFIC WILL ENTER OR EXIT THE CONSTRUCTION SITE ONTO A PUBLIC STREET.

2. INSTALL A CULVERT PIPE ACROSS THE ENTRANCE WHEN NEEDED TO PROVIDE POSITIVE DRAINAGE.

3. GEOTEXTILE FABRIC SHALL BE USED AS A BASE FOR THE CONSTRUCTION ENTRANCE.

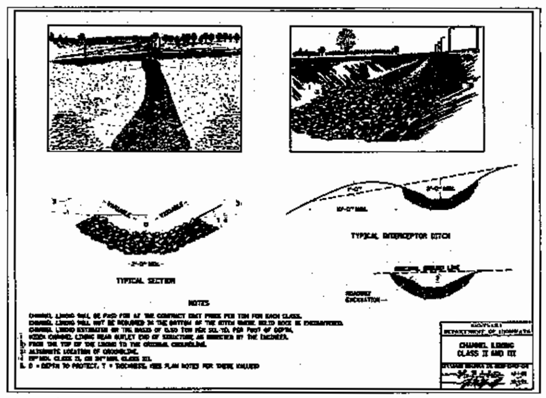
4. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC STREETS OR EXISTING PAVEMENT. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS WARRANT AND REPAIR OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.

5. ANY SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC STREETS OR INTO STORM DRAINS MUST BE REMOVED IMMEDIATELY.

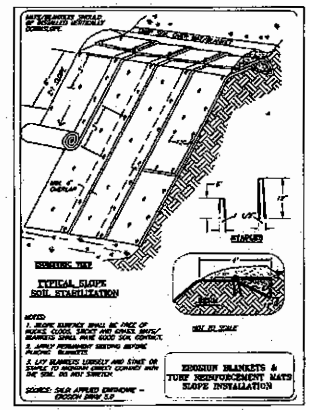
6. WHEN APPROPRIATE, WHEELS MUST BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTERING A PUBLIC STREET. WHEN WASHING IS REQUIRED, IT SHALL BE DONE IN AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT BASIN.

7. REMOVE CONSTRUCTION ENTRANCES AS SOON AS THEY ARE NO LONGER NEEDED TO PROVIDE ACCESS TO THE SITE. BRING THE DISTURBED AREA TO GRADE, AND STABILIZE IT USING APPROPRIATE PERMANENT STABILIZATION METHODS.

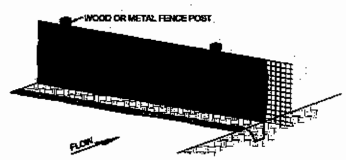
CONSTRUCTION ENTRANCE DETAIL
N.T.S.



RIPRAP CHANNEL LINING
N.T.S.



EROSION CONTROL BLANKET DETAIL
N.T.S.



NOTES:

1. FENCE POST SHALL BE AT LEAST 5 FEET LONG, AND METAL FENCE SHALL BE AT LEAST 14 GAUGE, 36 INCHES HIGH, AND WITH OPENINGS NO LARGER THAN 6 INCHES X 6 INCHES. GEOTEXTILE FABRIC SHALL BE A MATERIAL RECOMMENDED FOR THIS USE BY THE MANUFACTURER.
2. THE BOTTOM 12 INCHES OF FABRIC SHALL BE BURIED IN A 6 INCH TRENCH CUT INTO THE GROUND TO PREVENT SEDIMENT ESCAPING UNDER THE FENCE. ALL EARTHWORK SHALL BE ON THE UPSTREAM SIDE OF THE FENCE.
3. FENCE POST AND FABRIC WILL BE ACCEPTED BASED ON VISUAL INSPECTION BY THE ENGINEER IN THE FIELD; GEOTEXTILE FABRIC WILL BE ACCEPTED UPON RECEIPT OF A CERTIFICATION FROM THE MANUFACTURER THAT IT IS SUITABLE FOR USE AS SILT FENCE.
4. THE SILT FENCE SHALL BE CONSTRUCTED AT LOCATIONS SHOWN ON THE PLANS OR DIRECTED BY THE ENGINEER. THE SILT FENCE SHALL BE ERECTED, BEFORE GRADING IS BEGUN, IN THE AREA TO BE PROTECTED. POSTS SHALL BE INSTALLED 6 TO 10 FEET SPACING (THE CLOSER SPACING SHOULD BE USED IN AREAS WHERE RAPID RUN OFF CAN BE EXPECTED) AND FENCE FABRIC ATTACHED. THE GEOTEXTILE FABRIC SHALL BE ATTACHED TO THE FENCE, ON THE UPSTREAM SIDE, USING STAPLES, HOG-RINGS, OR ANOTHER APPROVED METHOD.
5. DURING THE USEFUL LIFE OF SILT FENCE, IT SHALL BE MAINTAINED BY THE CONTRACTOR, AND SILT ACCUMULATIONS THAT THREATEN DAMAGE TO THE FENCE SHALL BE REMOVED. AFTER THE USEFULNESS OF THE FENCE HAS ENDED IT SHALL BE REMOVED AND DISPOSED OF, THE ACCUMULATED SILT EITHER BE REMOVED OR DRESSED IN PLACE AS DIRECTED, AND THE ENTIRE AREA SEEDED AND PROTECTED.

TEMPORARY SILT FENCE
N.T.S.

MALCOLM PIRNIE

STRAND ASSOCIATES, INC. ENGINEERS

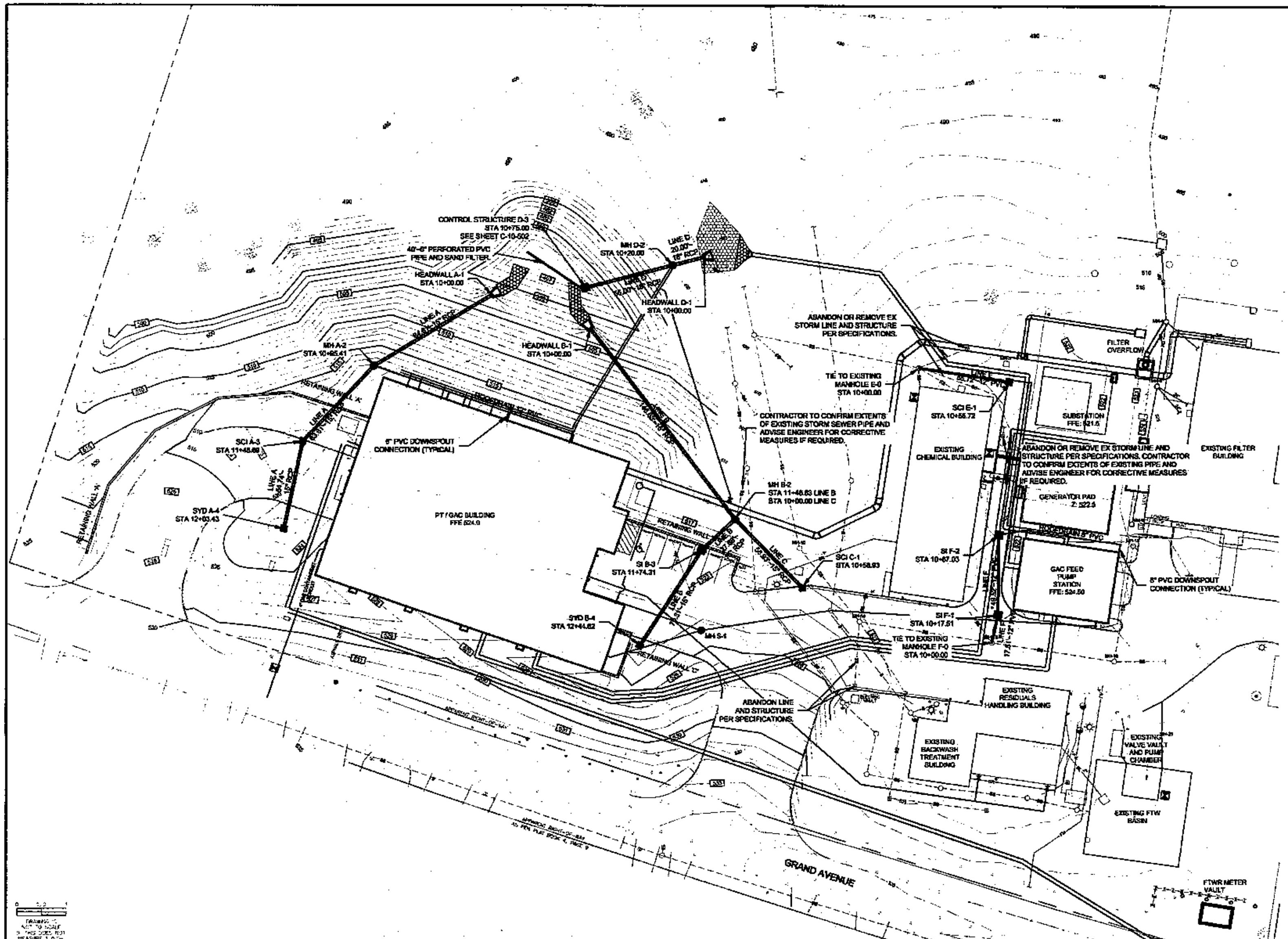
DES CJR
DWN CSD
CKD MAW

NORTHERN KENTUCKY WATER DISTRICT
TAYLOR MILL WATER TREATMENT PLANT
ADVANCED TREATMENT IMPROVEMENTS

CIVIL
EROSION CONTROL DETAILS

SCALE: NOT TO SCALE

ISSUED STATUS: 100% SUBMITTAL
DATE OCTOBER, 2010
SHEET C-01-502
CAD REF. NO. STRAND-C-01-502



STORM SEWER NOTES:

BEFORE PROCEEDING WITH THE WORK, THE CONTRACTOR SHALL CONFER WITH ALL PUBLIC OR PRIVATE COMPANIES, AGENCIES, OR DEPARTMENTS THAT OWN AND OPERATE UTILITIES IN THE VICINITY OF THE CONSTRUCTION.

EXISTING UNDERGROUND UTILITIES AND SERVICES ARE SHOWN IN THEIR APPROXIMATE LOCATIONS ACCORDING TO AVAILABLE INFORMATION. THE LOCATIONS SHOWN ARE INTENDED ONLY AS A GUIDE AND CANNOT BE GUARANTEED ACCURATE.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR:

A. CONTACTING THE INDIVIDUAL UTILITY OWNERS TEN DAYS PRIOR TO CONSTRUCTION, ADVISING THEM OF THE WORK TO TAKE PLACE.
B. SOLICITING THEIR AID IN LOCATING AND PROTECTING ANY UTILITY WHICH MAY INTERFERE WITH CONSTRUCTION.
C. EXCAVATING AND VERIFYING THE HORIZONTAL AND VERTICAL LOCATION OF EACH UTILITY.
D. DAMAGE TO EXISTING UTILITIES DUE TO CONTRACTOR'S OPERATIONS.

CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE WHEN GAS LINES ARE EXPOSED WHICH CROSS OR LIE WITHIN 6' OF PUBLICLY MAINTAINED STORM AND SANITARY SEWER FACILITIES.

SD1 STANDARDS FOR CONSTRUCTION APPLY TO THE PUBLIC STORM SYSTEM. THE CONTRACTOR SHALL PERFORM ALL TESTING REQUIRED TO MEET THE APPROVAL OF THE SD1 AS PART OF THE LUMP SUM BID.

CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING DRAINAGE STRUCTURES TO MATCH FINISHED GRADE ELEVATIONS AS PART OF THE LUMP SUM BID.

ALL STORM MANHOLES ARE 4' DIAMETER UNLESS OTHERWISE NOTED.

PRIOR TO TESTING, ALL LINES SHALL BE RODDED OUT WITH THE APPROPRIATE TOOLS FOR THE REMOVAL OF ALL DIRT, TRASH, OR DEBRIS.

STORM SEWER PIPING SHALL BE TESTED IN ACCORDANCE WITH SD1 SPECIFICATIONS.

ALL TESTING MUST BE WITNESSED BY THE OWNERS REPRESENTATIVE. THE CONTRACTOR SHALL NOTIFY THE OWNERS REPRESENTATIVE OF HIS INTENTIONS TO CONDUCT PERFORMANCE TESTING AT LEAST 72 HOURS (3 DAYS) BEFORE ANY SCHEDULED TEST. RESULTS OF EACH TEST MUST BE PROVIDED TO THE OWNER, FOR THEIR RECORDS, AS WELL AS IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

DETAILED DESIGN AND CONSTRUCTION OF ALL PRECAST STRUCTURES IS THE RESPONSIBILITY OF THE CONTRACTOR. SD1 STANDARDS (OR OTHERS AS SPECIFIED) SHALL BE FOLLOWED FOR CONSTRUCTION OF ALL PRECAST STRUCTURES. IF PLAN CONFIGURATIONS PREVENT ADHERENCE TO THESE STANDARDS THE PRECASTER SHALL CONTACT THE OWNERS REPRESENTATIVE PRIOR TO FABRICATION OF THE STRUCTURE FOR DESIGN REVISIONS. THIS INCLUDES, BUT IS NOT LIMITED TO, PROVISION FOR GRADE RINGS TO ADJUST MANHOLE LIDS, MINIMUM ALLOWABLE DISTANCES BETWEEN OR ABOVE PIPES AND THE DISTANCE BETWEEN BOTTOM SLABS AND PIPE INVERTS.

COORDINATE REFERENCE TABLE

STRUCTURE	NORTHING	EASTING
A-1	559269.08	156734.74
A-2	559225.41	1567272.27
A-3	559179.18	1567228.59
A-4	559125.85	1567217.15
B-1	559248.64	1567404.24
B-2	559131.57	1567402.64
B-3	559112.69	156772.43
B-4	559053.64	1567434.42
C-1	559069.37	1567533.80
D-1	559292.38	1567473.86
D-2	559287.31	1567454.51
D-3	559273.40	1567401.29
E-1	559215.81	1567860.04
F-1	559072.63	1567853.01
F-2	559122.04	1567853.73

MALCOLM PIRNIE

STRAND ASSOCIATES, INC. ENGINEERS

STATE OF KENTUCKY
CHRISTOPHER S. DENT
28087
LICENSED
PROFESSIONAL ENGINEER

REVISIONS

NO.	BY	DATE	REMARKS

DES CJR
DRN CSD
CKD MAW

NORTHERN KENTUCKY WATER DISTRICT
TAYLOR MILL WATER TREATMENT PLANT
ADVANCED TREATMENT IMPROVEMENTS

CIVIL
YARD PIPING - STORM SEWERS

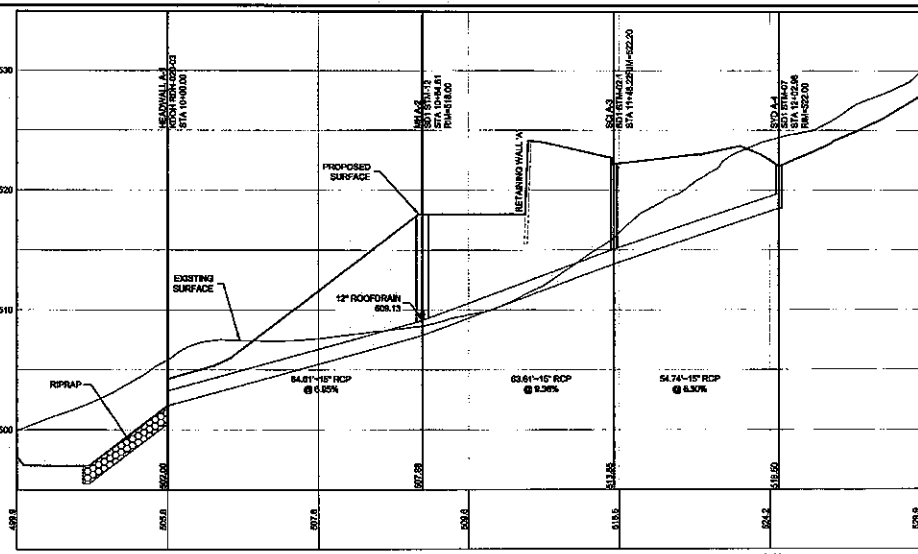
SCALE: 1" = 30'

ISSUED STATUS: 100% SUBMITTAL
DATE OCTOBER, 2010
SHEET C-02-312
CAD REF. NO. STRAND-C-02-312

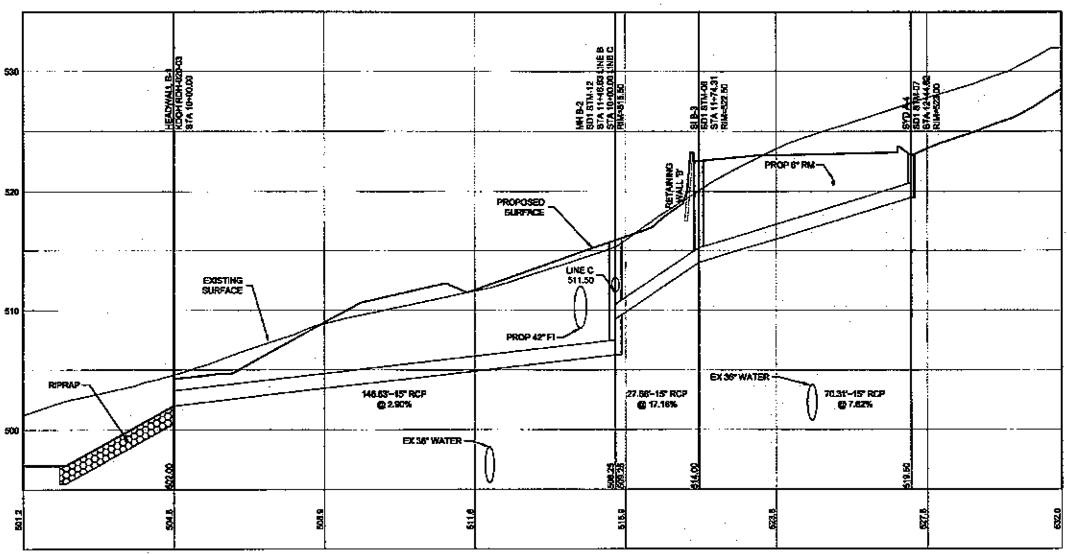
STORM SEWER PROFILE NOTES:

DETAILED DESIGN AND CONSTRUCTION OF ALL PRECAST STRUCTURES IS THE RESPONSIBILITY OF THE CONTRACTOR. SD1 STANDARDS (OR OTHERS AS SPECIFIED) SHALL BE FOLLOWED FOR CONSTRUCTION OF ALL PRECAST STRUCTURES. IF PLAN CONFIGURATIONS PREVENT ADHERENCE TO THESE STANDARDS THE PRECASTER SHALL CONTACT THE OWNERS REPRESENTATIVE PRIOR TO FABRICATION OF THE STRUCTURE FOR DESIGN REVISIONS. THIS INCLUDES, BUT IS NOT LIMITED TO, PROVISION FOR GRADE RINGS TO ADJUST MANHOLE LIDS, MINIMUM ALLOWABLE DISTANCES BETWEEN OR ABOVE PIPES AND THE DISTANCE BETWEEN BOTTOM SLABS AND PIPE INVERTS.

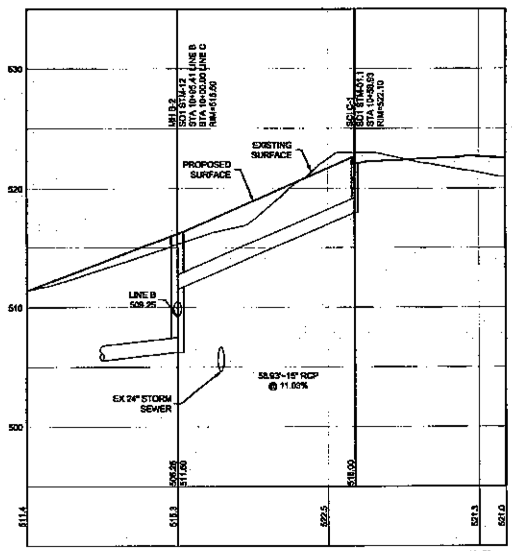
RIM ELEVATIONS ARE PROVIDED TO GUIDE THE CONTRACTOR IN BIDDING AND CONSTRUCTING DRAINAGE STRUCTURES. THE CONTRACTOR SHALL ADJUST RIM ELEVATIONS AS NECESSARY TO PROVIDE APPROPRIATE DRAINAGE. CURB INLET RIM ELEVATIONS IDENTIFY THE ELEVATION AT THE GRATE IN THE VICINITY OF THE CENTER OF THE PIPE CHAMBER. THE TOP PHASE OF ALL CURB INLETS SHALL BE ADJUSTED TO MATCH ADJACENT CURB AND/OR STREET GRADES.



STORM LINE A



STORM LINE B



STORM LINE C

MALCOLM PIRNIE

STRAND ASSOCIATES ENGINEERS

CHRISTOPHER C. CENT 26087 LICENSED PROFESSIONAL ENGINEER

REVISIONS

DES. CJR
DWN. CSD
CKD. MAW

NORTHERN KENTUCKY WATER DISTRICT
TAYLOR MILL WATER TREATMENT PLANT

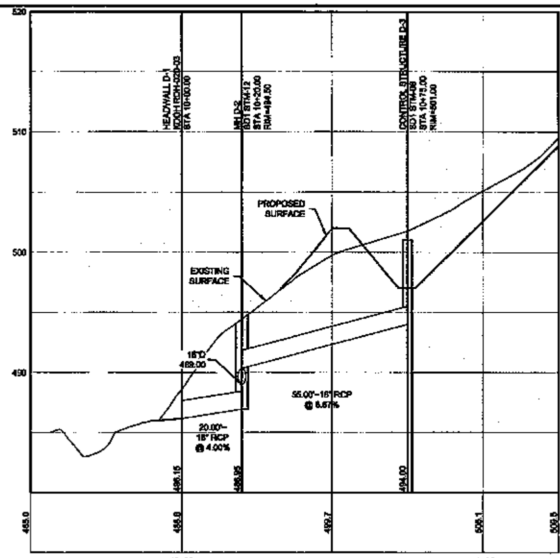
ADVANCED TREATMENT IMPROVEMENTS

CIVIL

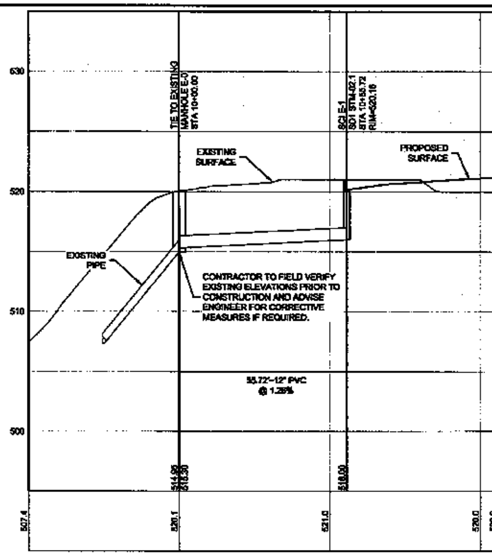
YARD PIPING PROFILES - STORM SEWER PROFILES I

SCALE: 1" = 30'

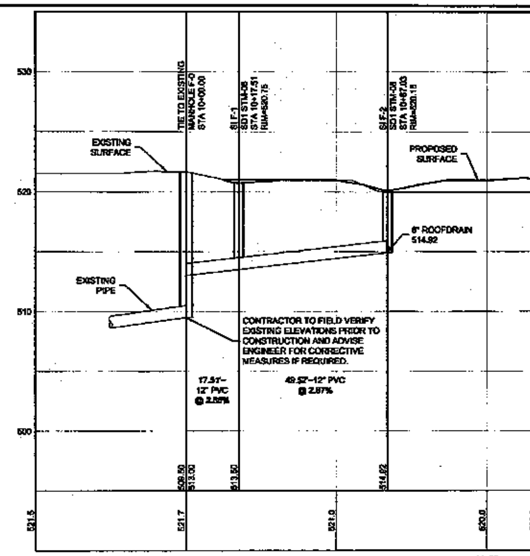
ISSUED STATUS: 100% SUBMITTAL
DATE: OCTOBER, 2010
SHEET: C-02-313
CAD REF. NO. STRAND-C-02-313



STORM LINE D



STORM LINE E



STORM LINE F

STORM SEWER PROFILE NOTES:

DETAILED DESIGN AND CONSTRUCTION OF ALL PRECAST STRUCTURES IS THE RESPONSIBILITY OF THE CONTRACTOR. SD1 STANDARDS (OR OTHERS AS SPECIFIED) SHALL BE FOLLOWED FOR CONSTRUCTION OF ALL PRECAST STRUCTURES. IF PLAN CONFIGURATIONS PREVENT ADHERENCE TO THESE STANDARDS THE PRECASTER SHALL CONTACT THE OWNERS REPRESENTATIVE PRIOR TO FABRICATION OF THE STRUCTURE FOR DESIGN REVISIONS. THIS INCLUDES, BUT IS NOT LIMITED TO, PROVISION FOR GRADE RINGS TO ADJUST MANHOLE LIDS, MINIMUM ALLOWABLE DISTANCES BETWEEN OR ABOVE PIPES AND THE DISTANCE BETWEEN BOTTOM SLABS AND PIPE INVERTS.

RIM ELEVATIONS ARE PROVIDED TO GUIDE THE CONTRACTOR IN BIDDING AND CONSTRUCTING DRAINAGE STRUCTURES. THE CONTRACTOR SHALL ADJUST RIM ELEVATIONS AS NECESSARY TO PROVIDE APPROPRIATE DRAINAGE. CURB INLET RIM ELEVATIONS IDENTIFY THE ELEVATION AT THE GRATE IN THE VICINITY OF THE CENTER OF THE PIPE CHAMBER. THE TOP PHASE OF ALL CURB INLETS SHALL BE ADJUSTED TO MATCH ADJACENT CURB AND/OR STREET GRADES.

MALCOLM PIRNIE

STRAND ASSOCIATES, INC. ENGINEERS

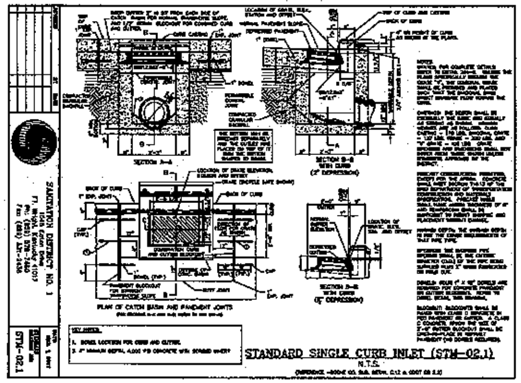
REVISIONS

DES CJR
DRN CSD
CKD MAW

NORTHERN KENTUCKY WATER DISTRICT
TAYLOR MILL WATER TREATMENT PLANT
ADVANCED TREATMENT IMPROVEMENTS

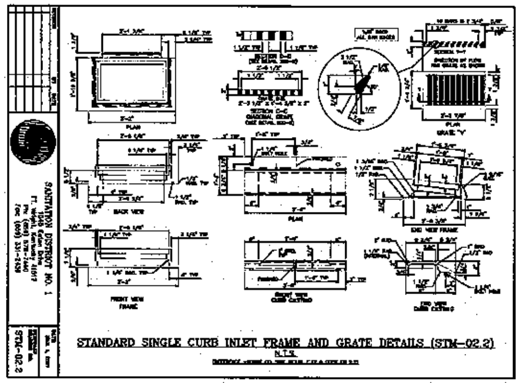
CIVIL
YARD PIPING PROFILES - STORM SEWER PROFILES II
SCALE: 1" = 30'

ISSUED STATUS: 100% SUBMITTAL
DATE OCTOBER, 2010
SHEET C-02-314
CAD REF. NO. STRAND-C-02-314



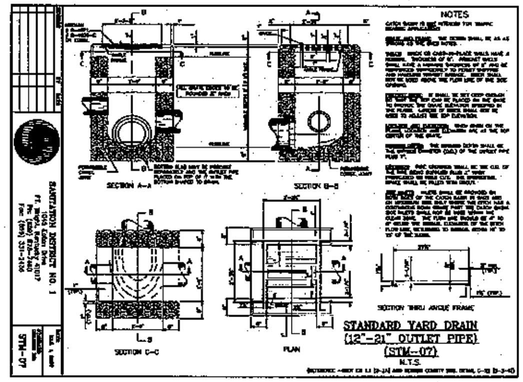
STANDARD SINGLE CURB INLET (STM-02.1)

N.T.S.



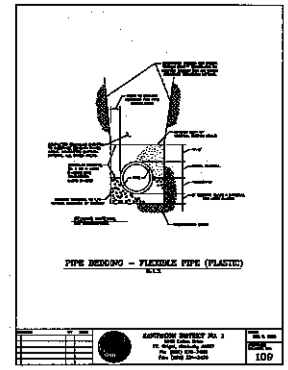
STANDARD SINGLE CURB INLET FRAME AND GRATE DETAILS (STM-02.2)

N.T.S.



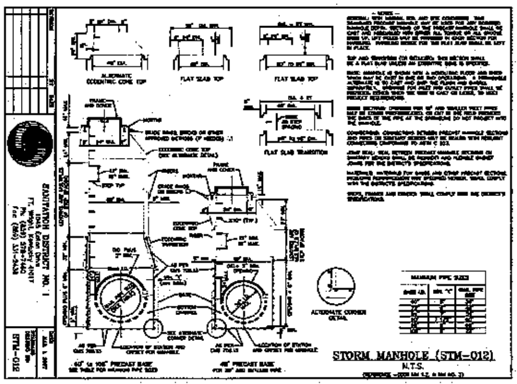
STANDARD YARD DRAIN (12"-21" OUTLET PIPE) (STM-07)

N.T.S.



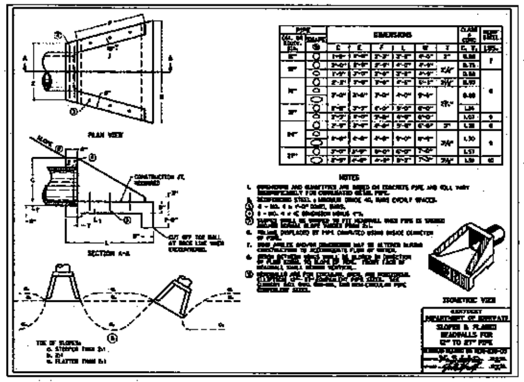
PIPE BEDDING – FLEXIBLE PIPE (PLASTIC)

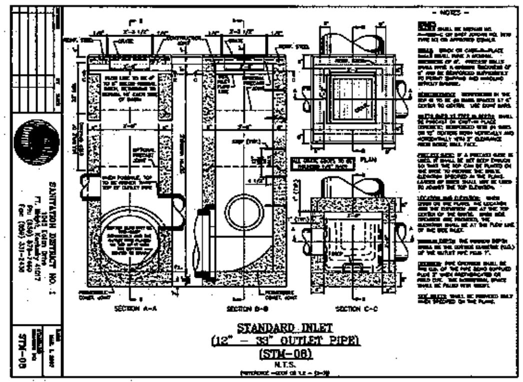
N.T.S.



STORM MANHOLE (STM-012)

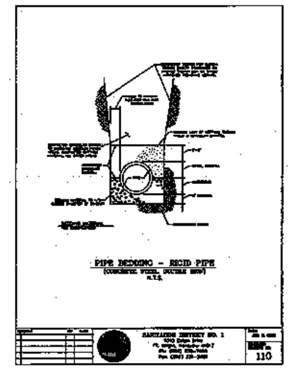
N.T.S.





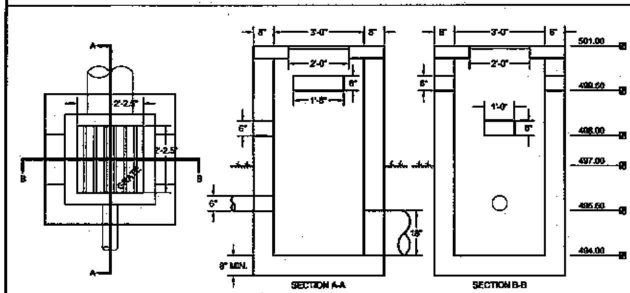
STANDARD INLET (12" – 33" OUTLET PIPE) (STM-08)

N.T.S.



PIPE BEDDING – RIGID PIPE

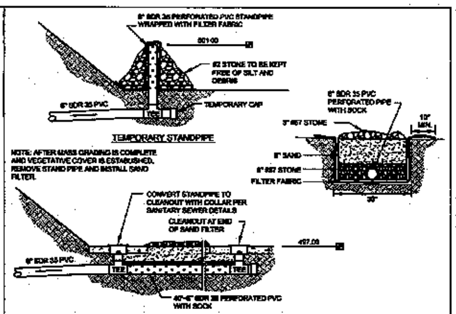
N.T.S.



CONTROL STRUCTURE D-3 DIMENTIONS SHALL REFERENCE SD1 STANDARD INLET STM-08. THIS REPRESENTATION IS FOR CLARIFICATION OF OPENINGS ONLY.

CONTROL STRUCTURE D-3

N.T.S.



TEMPORARY STANDPIPE & PERMANENT SAND FILTER

N.T.S.

MALCOLM PIRNIE

STRAND ASSOCIATES, INC. ENGINEERS

REVISIONS

NO.	BY	DATE	REMARKS

DES CJR

DWN CSD

CKD MAW

NORTHERN KENTUCKY WATER DISTRICT

TAYLOR MILL WATER TREATMENT PLANT

ADVANCED TREATMENT IMPROVEMENTS

CIVIL

STORM SEWER DETAILS

SCALE: NOT TO SCALE

ISSUED STATUS: 100% SUBMITTAL

DATE OCTOBER, 2010

SHEET C-10-502

CAD REF. NO. STRAND-C-10-502

STRAND
ASSOCIATES, INC.
ENGINEERS

Suite 100
1525 Bull Lea Road
Lexington, KY 40511
Phone: 859-225-8500
Fax: 859-225-8501

Office Locations

Madison, WI
Joliet, IL
Louisville, KY
Lexington, KY
Mobile, AL
Columbus, IN
Columbus, OH
Indianapolis, IN
Milwaukee, WI
Cincinnati, OH
Phoenix, AZ

www.strand.com

November 2, 2010

Mr. Sean Blake
Sanitation District No.1
1045 Eaton Drive
Ft. Wright, KY 41017

Re: Taylor Mill Water Treatment Plant Stormwater Report

Dear Mr. Blake:

Enclosed is one copy of the Northern Kentucky Water District Taylor Mill Water Treatment Plant Stormwater Report. The report provides a brief summary of the proposed proposed storm sewers and detention basin for the Taylor Mill Water Treatment Plant advanced treatment improvements. Also enclosed is a completed Sanitation District No. 1 Land Disturbance Permit as well as plan review and inspection fee as required by Sanitation District No. 1.

Please call with any questions.

Sincerely,

STRAND ASSOCIATES, INC.®

Christoph S Dent

Christopher S. Dent, P.E.

Enclosure: Report

c: Jason Abbott, Malcolm Pirnie, Inc.
Amy Kramer

LAND DISTURBANCE PERMIT APPLICATION FORM

Note: The application form and supporting documentation must be completed in its entirety and delivered to **Sanitation District No. 1 – Storm Water Department, 1045 Eaton Drive, Ft. Wright, KY 41017** to begin the review process. The omission of required items may be cause for rejection of the submittal without review.

Project Name:	Taylor Mill Treatment Plant Advanced Treatment Improvements		
Project Address:	608 Grand Avenue, Taylor Mill, KY 41015		
Subdivision Name/Lot No.:	N/A		
Parcel ID From County PVA:	056-20-02-027.02		
District Permit Previously Issued: ☐ Yes ☒ No		If Yes, Previous Permit No.:	
Permit Previously Issued From Other Agency(ies): ☒ Yes ☐ No		If Yes, Describe:	KPDES #KYG640000
Total Area Of Project Site (Acres):	6.60	Total Impervious Area For Property (Square Feet):	86.654
Total Area of Land Disturbing Activities (Acres):	4.75		

Property Owner:	Northern Kentucky Water District	Contact Person:	Amy Kramer
Address:	2835 Crescent Springs Road, P.O. Box 18640, Erlanger, KY 41018		
Telephone:	859-426-2734	Fax:	859-578-7893
E-mail:	akramer@nkywater.org		
Developer:	N/A	Contact Person:	
Address:			
Telephone:		Fax:	
E-mail:			
Designer:	Strand Associates, Inc.®	Contact Person:	Christopher S. Dent
Address:	1525 Bull Lea Road, Suite 100, Lexington, KY 40511		
Telephone:	859-225-8500	Fax:	859-225-8501
E-mail:	chris.dent@strand.com		

Checklist: The purpose of this checklist is to expedite and facilitate the review process. This checklist gives the minimum requirements needed for District review. All items shall be checked as included or marked as N/A. If an item is marked as N/A, provide an explanation in the section entitled Comments below.

X	Project Information
X	Location Map
N/A	Property Boundary and Adjacent Property Owners
X	Clearing Limits
X	Improvement Drawings (with Scale Not Smaller Than 1 Inch Equals 100 Feet)
X	Existing and Proposed Contours and Location And Description Of Benchmark Used
X	Existing and Proposed Public And Private Rights-Of-Ways And Streets
X	Location Of Proposed Storm Water and Water Resource Facilities Including Manholes, Pump Stations, Catch Basins, Inlets, And Headwalls.
X	Detention/Retention Facilities Clearly Identified With the Maximum Volume Capcities Labeled And Detailed Drawings Of All Overflow Facilities
X	Storm Water Facilities (Inlets, Catch Basins, Junction Boxes, Headwalls, Manholes, Etc.) Numbered And Corresponding To The Profiles Of Storm Sewers And Culverts
N/A	Maintenance Responsibility For Detention/Retention Facilities And Maintenance Activities Noted On The Improvement Drawings
X	Profiles Of All Proposed Storm Water Sewers, Culverts, And Facilities (Including Percent Grade, Pipe Diameters, Material, And Lengths, And Invert Elevations). Profiles Shall Also Show All Existing And

X	Proposed Public Utility (Water, Storm And Sanitary Sewer) Crossings, And All Existing Private Utility (Gas, Electric, Telephone, Etc.) Crossings.
X	Hydraulic Grade Lines For The 10-Year And 25-Year Design Storms
X	Outlet Velocities At All Headwalls And Outlets Of Storm Sewers And Culverts
N/A	Location and Identification Of Any Drainage Facility or Natural Feature On The Site or Within 100 Feet Of The Project Boundary That Has Or Could Have An Impact On Drainage or Sediment Control
X	Existing Utilities, Sewers, and Storm Drainage Structures And Facilities. Also Connections To Existing Facilities Shown And Labeled.
N/A	Adjoining Storm Drainage Structures And Facilities To Show Continuity In The Overall Storm Water Drainage System, If This Project Is One Phase Of A Multi-Phase Development
N/A	Proposed Easements
X	Erosion Prevention And Sediment Control Plan
X	Location, Details, And Standard Drawings for BMPs (I.E. Stabilized Construction Entrances, Perimeter Controls, Inlet and Outlet Protection For Storm Sewers And Culverts, Stream Crossings)
X	Computations To Support all Drainage and Sediment Control Designs In A Form Meeting The District's Requirements And Sealed Be The Kentucky Licensed Professional Engineer Preparing The Designs
N/A	Electronic Copy Of Submittal (If Computer Generated)

	Required Fees (Compute on The Right	Plan Review Fee:	= $500.00
		Inspection Fee: ($50.00 Per Acre Of Land Disturbing Activities, Not To Exceed $500.00)	250.00
		Total	$750.00

Comments: (Special Notes That May Pertain To Project)
Attach Additional Sheet If Necessary: ☐ Yes ☒ No

1) Maintenance of Detention/Retention Facilities is the responsibility of the Owner.
2) Banklick Creek north of property and no improvements within 100 feet of Banklick Creek.

Certifications: The following certifications are required.

Owner/Person Financially Responsible Certification: "I hereby certify that all land disturbing construction and associated activity pertaining to this permit application shall be accomplished pursuant to the approved plans. The information submitted with the applications is, to the best of my knowledge and belief, true, accurate, and complete.

Printed Name of Owner/Person Financially Responsible: Amy Kramer

Signature: Amy Kramer Date: 10/27/10

Right of Entry Certification for Inspection: "I hereby grant authorization to Sanitation District No. 1 and/or designated representatives the right of access to the site at all times for the purpose of site inspections during the period of construction and to perform maintenance inspections following the completion of the land disturbing activity."

Printed Name of Owner/Person Financially Responsible: Amy Kramer

Signature: Amy Kramer Date: 10/27/10

Designer Certification: "I hereby certify to the best of my knowledge and belief that the measures in this plan are designed to control erosion, retain sediment on the site, and manage storm water in a manner that is in compliance with the requirements contained in the Sanitation District No. 1 rules and regulations."

Printed Name of Engineer: Christopher S. Dent

Kentucky PE Number: 26087

Date: 11/1/2010

11/1/2010
STATE OF KENTUCKY
CHRISTOPHER S. DENT
26087
LICENSED PROFESSIONAL ENGINEER
(Stamp and Signature)

Report

Taylor Mill Water Treatment Plant Stormwater Report

Northern Kentucky Water Distict

October 2010

Report for
Northern Kentucky Water District
Erlanger, Kentucky

Taylor Mill Water Treatment Plant
Stormwater Report

11/3/2010

STATE OF KENTUCKY
CHRISTOPHER S. DENT
26087
LICENSED
PROFESSIONAL ENGINEER

Prepared by:

STRAND ASSOCIATES, INC.®
1525 Bull Lea Road, Suite 100
Lexington, KY 40511
www.strand.com

October 2010

STRAND
ASSOCIATES, INC.®
ENGINEERS

TABLE OF CONTENTS

Page No.
or Following

PROJECT DESCRIPTION

The Northern Kentucky Water District (NKWD) has developed plans to construct advanced treatment improvements at the Taylor Mill Water Treatment Plant, located at 608 Grand Avenue in Taylor Mill, Kentucky. The proposed improvements at the site include the removal of two existing water treatment plant sedimentation basins and the construction of a Granular Activated Carbon (GAC) building, GAC feed pump station, generator pad, and substation. Additional driveways will be constructed to allow for truck access through the GAC building.

The majority of the runoff from the existing site is currently conveyed through a series of storm sewers before discharging at a headwall at the northern end of the project site. An existing drainage ditch conveys the flow from the headwall to Banklick Creek, located approximately 180 feet from the discharge point. There is also existing runoff that sheet flows from portions of the site to the Banklick Creek. Approximately 6.09 acres of the site were analyzed for this report. No improvements or modifications from the existing conditions are proposed for the portion of the site not analyzed. The project site does not currently have any stormwater detention; however, the proposed design includes a detention basin to detain stormwater runoff resulting from the proposed development.

In an effort to promote sustainable alternatives or green infrastructure at the project site, NKWD plans to construct a 12,500-square-foot vegetative roof on the GAC building. The vegetative roof will result in water quantity reductions and water quality improvements from the new GAC building. In addition, the proposed detention basin includes a sand filter in the bottom of the basin to further improve the water quality as runoff leaves the site and discharges to Banklick Creek.

STORM SEWER DESIGN

New storm sewers have been included in the design of the advanced treatment improvements at the site to convey stormwater runoff to the proposed detention basin and to the existing infrastructure system. The diameter of the new storm sewers ranges from 12 inches to 15 inches, and the length is approximately 630 feet. The storm sewers were modeled for a range of design storms to confirm capacity and hydraulic grade lines. Appendix A contains a copy of the model output for the storm sewers. The standard Sanitation District No. 1 details and notes are referenced in the drawings for the proposed storm sewer structures, including inlets and manholes.

DETENTION BASIN DESIGN

The advanced treatment improvements at the site result in an additional 0.45 acres of impervious surfaces. As a result, a stormwater detention basin has been proposed at the northern end of the site to detain stormwater runoff at or below predevelopment flow rates. The detention basin also includes a sand filter in the bottom of the basin to improve water quality before discharging near the location of the existing headwall.

The total storage capacity of the detention basin is 10,256 cubic feet (0.24 acre-feet). Stormwater modeling was generated for a range of design storms to confirm the postdevelopment peak flow rates were equal to or smaller than predevelopment peak flow rates. Appendix B contains a copy of the model output for the detention basin.

Table 1 is a summary of the predevelopment and postdevelopment peak flow rates. For each of the design storms analyzed, the postdevelopment peak flow rates are smaller than the predevelopment peak flow rates. Table 2 is a brief summary of the peak flow elevations in the detention basin for the design storms analyzed. Table 3 is a summary of the outlet control structure within the detention basin. A detail of the outlet control structure is included in the design plans, Sheet C-105-02.

Unit	Area (AC)	CN	Q-2yr (CFS)	Q-10yr (CFS)	Q-25 yr. (CFS)	Q-50 yr (CFS)	Q-100 yr (CFS)
Existing Runoff from Site (CFS)	6.09	81	14.76	26.21	33.36	39.12	45.18
Proposed Runoff to Detention Basin (CFS)	2.07	86	6.26	10.32	12.79	14.76	16.82
Proposed Basin Outflow (CFS)			2.86	7.78	9.60	10.81	11.94
Proposed Runoff Not to Detention Basin (CFS)	4.02	85	11.66	19.50	24.29	28.12	32.12
Proposed Combined Runoff From Site (CFS)			14.07	26.08	32.94	37.94	42.99
Percent Reduction of Runoff			4.90%	0.50%	1.28%	3.11%	5.09%

Table 1 Predevelopment versus Postdevelopment Peak Flow Rates

Year Storm	Peak Elevation	Total Volume (cu ft)	Total Volume (AC-ft)	Peak Outflow (CFS)
2	499.53	3,731	0.0857	2.86
10	500.08	5,144	0.1181	7.78
25	500.33	5,890	0.1352	9.60
50	500.54	6,551	0.1504	10.81
100	500.77	7,301	0.1676	11.94

Table 2 Peak Storage Elevation in Detention Basin

Openings	Dimensions	Orientation	Elevation
Outflow Pipe	18-inch diameter		494.00
Inflow Sand Filter	6-inch diameter		495.50
Inflow Orifice 1	12-inch W x 6-inch H	Vertical	498.00
Inflow Orifice 2	20-inch W x 6-inch H	Vertical	499.50
Inflow Orifice 3	20-inch W x 6-inch H	Vertical	499.50
Inflow Orifice 4	24-inch W x 24-inch L	Horizontal	501.00
Emergency Spillway	5 feet		501.50

Table 3 Detention Basin Overflow Structure Details

EROSION PREVENTION AND SEDIMENT CONTROL DESIGN

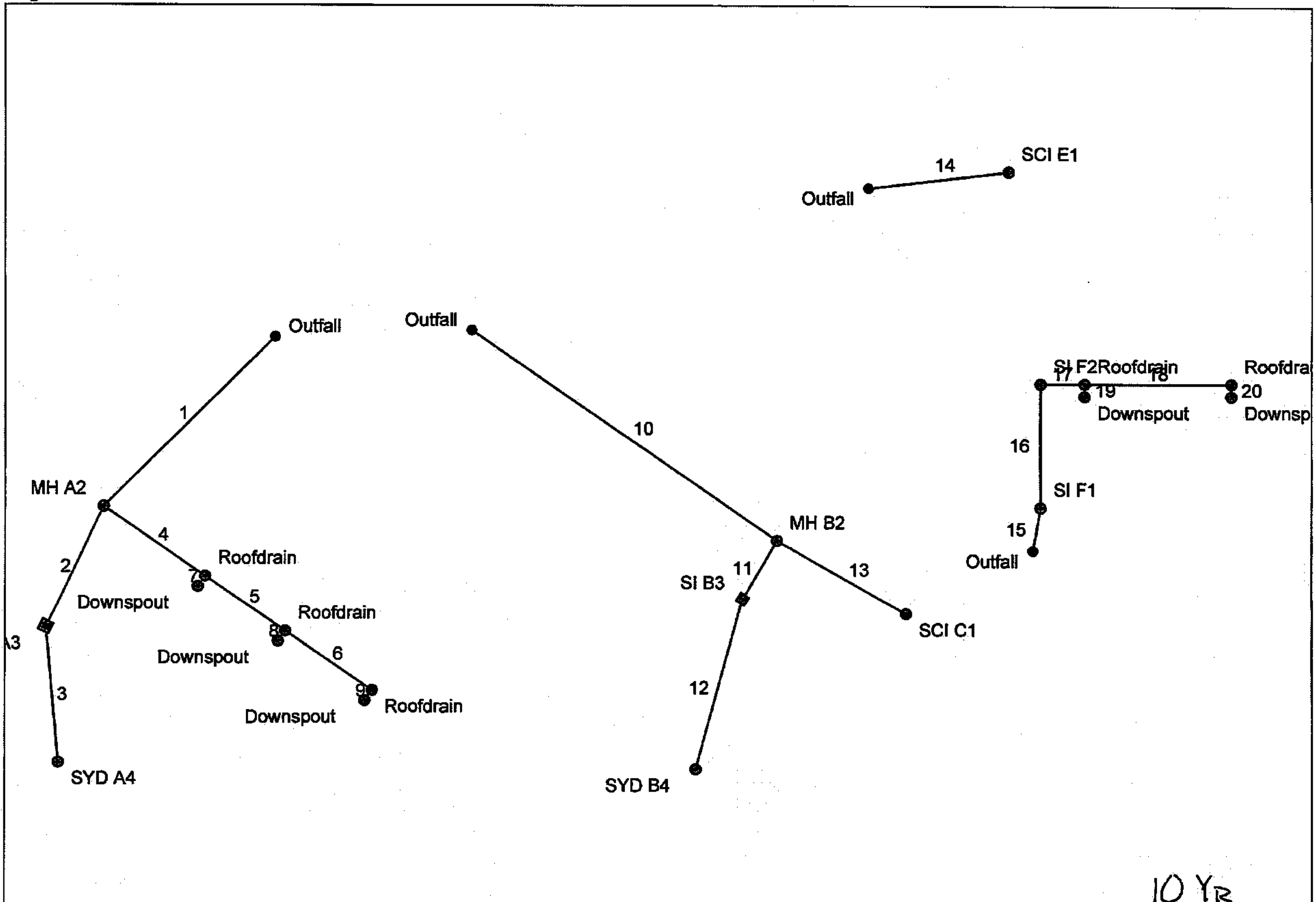
A variety of erosion control measures were included in the design to minimize the impacts of sedimentation during construction. The measures include the following:

1. Aggregate-lined construction entrance.
2. Concrete washout area located adjacent to construction entrance.
3. Silt traps around existing and proposed storm inlets.
4. Stone check dams in the existing drainage ditch.
5. Silt fence along northern (downhill) edge of limits of disturbance.
6. Erosion control blanket on all disturbed slopes.
7. Temporary standpipe within the detention basin during construction.

The erosion control plan is included in the design plans, Sheet C-01-105. The typical details associated with the erosion control plan are included in the design plans, Sheet C-01-502.

APPENDIX A
HYDRAFLOW STORM SEWER MODEL RESULTS

Hydraflow Storm Sewers Plan



Project File: Taylor Mill Storm Sewers 100.stm	Number of lines: 20	Date: 10-11-2010

Hydraflow Storm Sewers 2008 v12.01

Storm Sewer Tabulation

Station Line	Station To Line	Len (ft)	Drng Area Incr (ac)	Drng Area Total (ac)	Rnoff coeff (C)	Area x C Incr	Area x C Total	Tc Inlet (min)	Tc Syst (min)	Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe Size (in)	Pipe Slope (%)	Invert Elev Dn (ft)	Invert Elev Up (ft)	HGL Elev Dn (ft)	HGL Elev Up (ft)	Grnd / Rim Elev Dn (ft)	Grnd / Rim Elev Up (ft)	Line ID
1	End	95.41	0.00	1.00	0.00	0.00	0.60	0.0	11.1	5.3	3.18	17.30	4.39	15	7.18	502.00	508.85	502.71	509.56	504.00	516.00	A Outfall
2	1	53.28	0.32	0.79	0.70	0.22	0.41	10.0	10.4	5.4	2.24	19.78	3.03	15	9.38	508.85	513.85	509.81	514.45	516.00	522.20	A
3	2	54.74	0.47	0.47	0.40	0.19	0.19	10.0	10.0	5.5	1.04	18.82	2.10	15	8.49	513.85	518.50	514.67	518.91	522.20	522.50	A
4	1	48.59	0.00	0.21	0.00	0.00	0.19	0.0	10.8	5.4	1.01	3.58	2.44	12	1.01	509.13	509.62	509.84	510.05	516.00	518.00	Roofdrain
5	4	38.52	0.00	0.14	0.00	0.00	0.13	0.0	10.5	5.4	0.68	3.58	2.13	12	1.01	509.62	510.01	510.19	510.36	518.00	518.00	Roofdrain
6	5	41.94	0.00	0.07	0.00	0.00	0.06	0.0	10.0	5.5	0.35	3.56	1.61	12	1.00	510.01	510.43	510.48	510.68	518.00	518.00	Roofdrain
7	4	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	5.5	0.35	0.56	2.83	6	1.00	510.12	510.17	510.42	510.47	518.00	518.00	Downspout
8	5	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	5.5	0.35	0.56	2.83	6	1.00	510.51	510.56	510.81	510.86	518.00	518.00	Downspout
9	6	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	5.5	0.35	0.56	2.83	6	1.00	510.93	510.98	511.23	511.28	518.00	518.00	Downspout
10	End	146.63	0.00	0.70	0.00	0.00	0.41	0.0	10.7	5.4	2.18	10.99	3.82	15	2.90	502.00	506.25	502.59	506.84	504.00	515.50	B Outfall
11	10	27.68	0.12	0.58	0.90	0.11	0.29	10.0	10.5	5.4	1.58	26.75	3.42	15	17.16	509.25	514.00	509.75	514.50	515.50	522.50	B
12	11	70.31	0.46	0.46	0.40	0.18	0.18	10.0	10.0	5.5	1.02	18.06	2.24	15	7.82	514.00	519.50	514.67	519.90	522.50	523.50	B
13	10	58.93	0.12	0.12	0.95	0.11	0.11	10.0	10.0	5.5	0.63	21.45	2.57	15	11.03	511.50	518.00	511.82	518.32	515.50	522.10	C
14	End	55.72	0.13	0.13	0.60	0.08	0.08	10.0	10.0	5.5	0.43	3.99	2.41	12	1.26	515.30	516.00	515.58	516.28	520.30	520.16	E Outfall
15	End	17.51	0.16	0.38	0.85	0.14	0.33	10.0	11.4	5.2	1.70	6.02	3.82	12	2.86	513.00	513.50	513.55	514.05	517.00	517.86	F Outfall
16	15	49.52	0.16	0.22	0.85	0.14	0.19	10.0	11.0	5.3	1.01	6.03	2.37	12	2.87	513.50	514.92	514.25	515.35	517.86	520.16	F
17	16	17.23	0.00	0.06	0.00	0.00	0.05	0.0	10.8	5.3	0.29	1.20	1.21	8	0.99	514.92	515.09	515.46	515.46	520.16	523.00	Roofdrain
18	17	57.73	0.00	0.03	0.00	0.00	0.03	0.0	10.0	5.5	0.15	1.21	1.28	8	1.00	515.09	515.67	515.52	515.85	523.00	523.00	Roofdrain
19	17	5.00	0.03	0.03	0.90	0.03	0.03	10.0	10.0	5.5	0.15	0.56	1.77	6	1.00	515.26	515.31	515.52	515.51	523.00	523.00	Downspout
20	18	5.00	0.03	0.03	0.90	0.03	0.03	10.0	10.0	5.5	0.15	0.56	2.08	6	1.00	515.84	515.89	516.04	516.09	523.00	523.00	Downspout

Project File: Taylor Mill Storm Sewers 100.stm | Number of lines: 20 | Run Date: 10-11-2010

NOTES: Intensity = 53.90 / (Inlet time + 8.50) ^ 0.78; Return period = 10 Yrs. ; c = cir e = ellip b = box

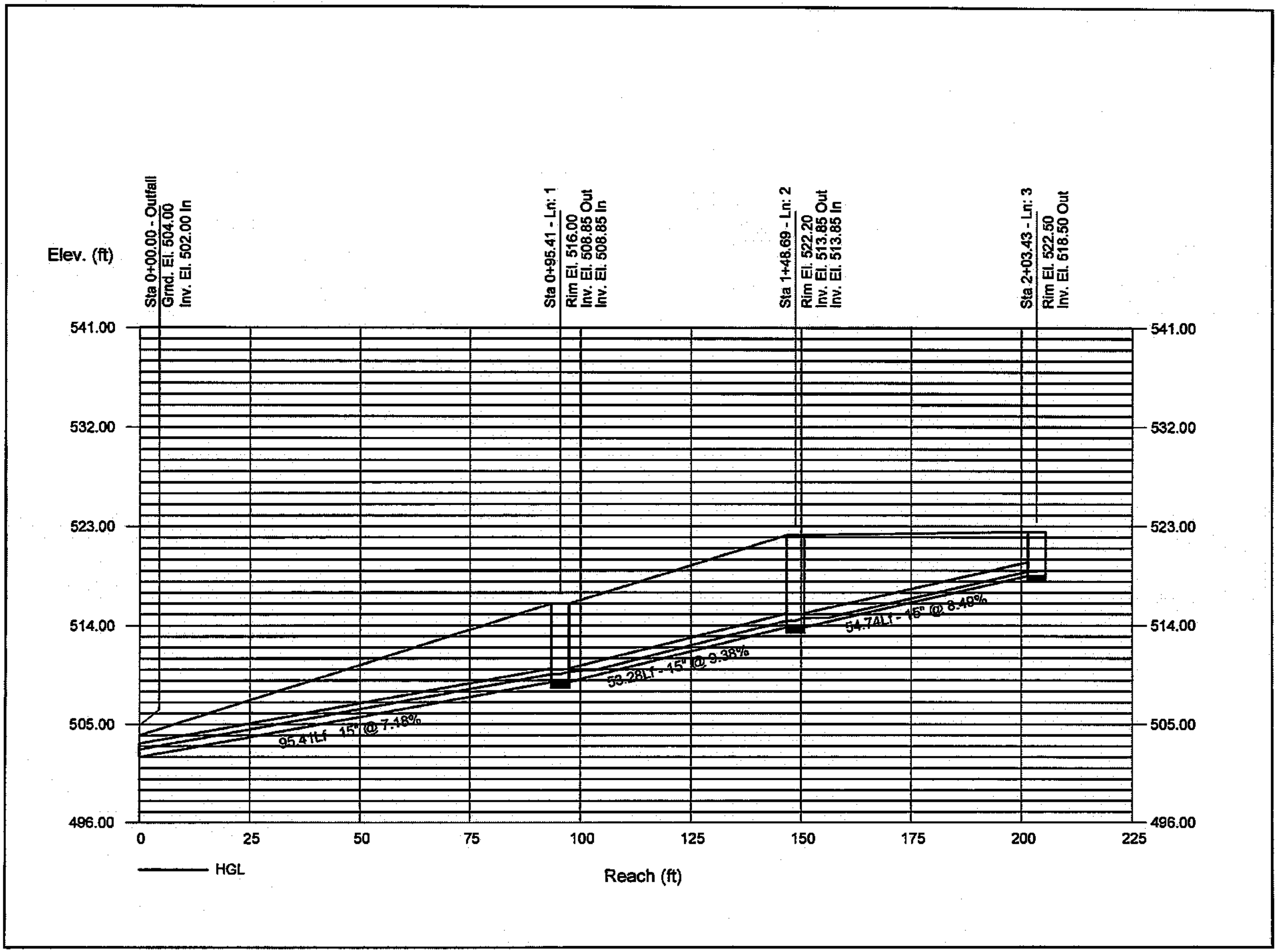
Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH A2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	SCI A3	1.24	0.00	1.24	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.17	5.50	0.17	5.50	0.0	Off
3	SYD A4	1.04	0.00	1.04	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.12	14.32	0.12	14.32	0.0	Off
4	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
5	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
6	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
7	Downspout	0.35	0.00	0.35	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.06	7.94	0.06	7.94	0.0	Off
8	Downspout	0.35	0.00	0.35	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.06	7.94	0.06	7.94	0.0	Off
9	Downspout	0.35	0.00	0.35	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.06	7.94	0.06	7.94	0.0	Off
10	MH B2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
11	SI B3	0.60	0.00	0.60	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.09	10.51	0.09	10.51	0.0	Off
12	SYD B4	1.02	0.00	1.02	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.12	14.14	0.12	14.14	0.0	Off
13	SCI C1	0.63	0.00	0.63	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.11	2.50	0.11	2.50	0.0	Off
14	SCI E1	0.43	0.00	0.43	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.09	1.80	0.09	1.80	0.0	Off
15	SI F1	0.75	0.00	0.75	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.10	11.93	0.10	11.93	0.0	Off
16	SI F2	0.75	0.00	0.75	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.10	11.93	0.10	11.93	0.0	Off
17	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
18	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
19	Downspout	0.15	0.00	0.15	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.03	5.38	0.03	5.38	0.0	Off
20	Downspout	0.15	0.00	0.15	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.03	5.38	0.03	5.38	0.0	Off

Project File: Taylor Mill Storm Sewers 100.stm | Number of lines: 20 | Run Date: 10-11-2010

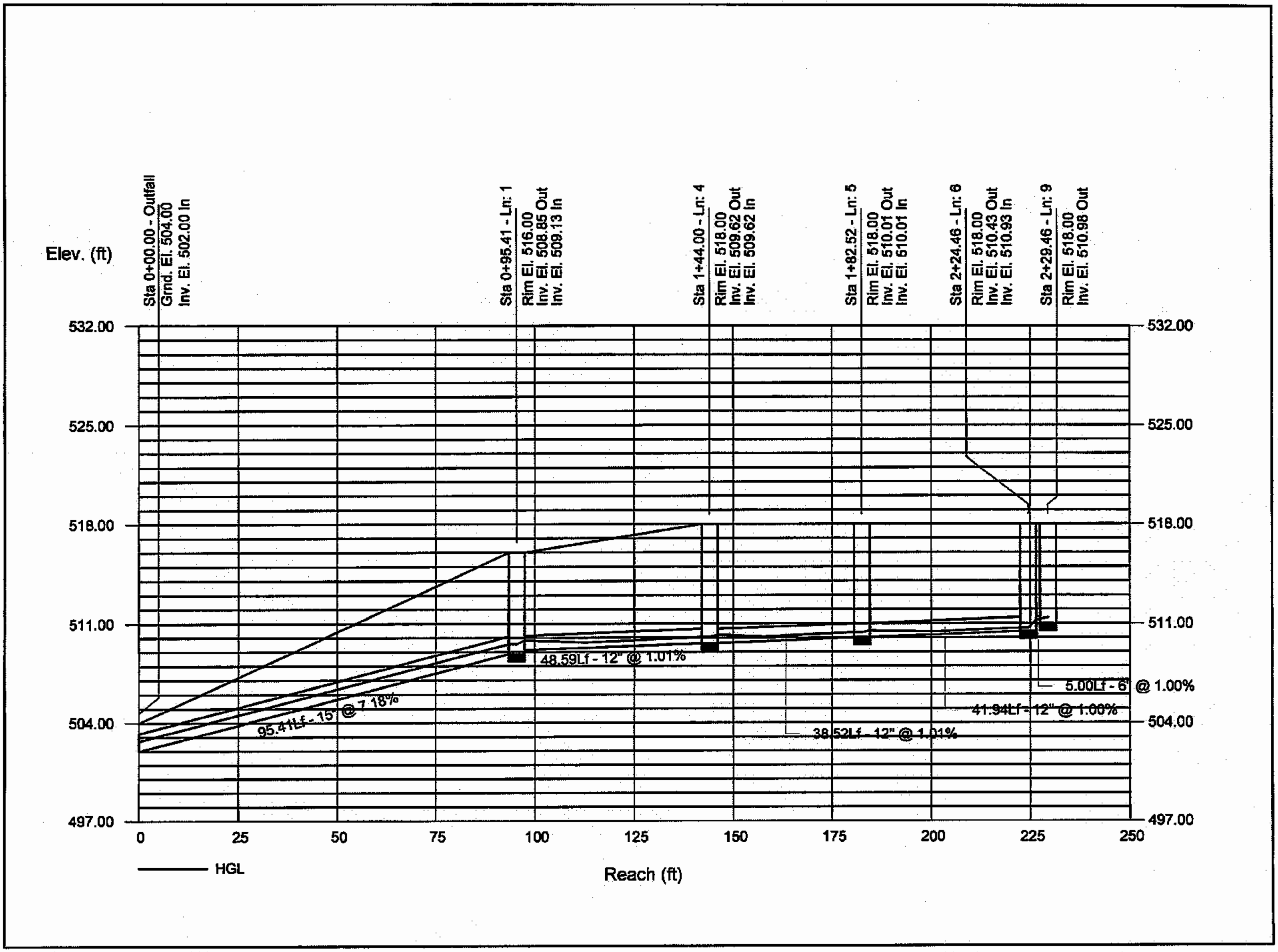
NOTES: Inlet N-Values = 0.016 ; Intensity = 53.90 / (Inlet time + 8.50) ^ 0.78; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Storm Sewer Profile



Storm Sewer Profile

Proj. file: Taylor Mill Storm Sewers 100.stm



Storm Sewer Profile

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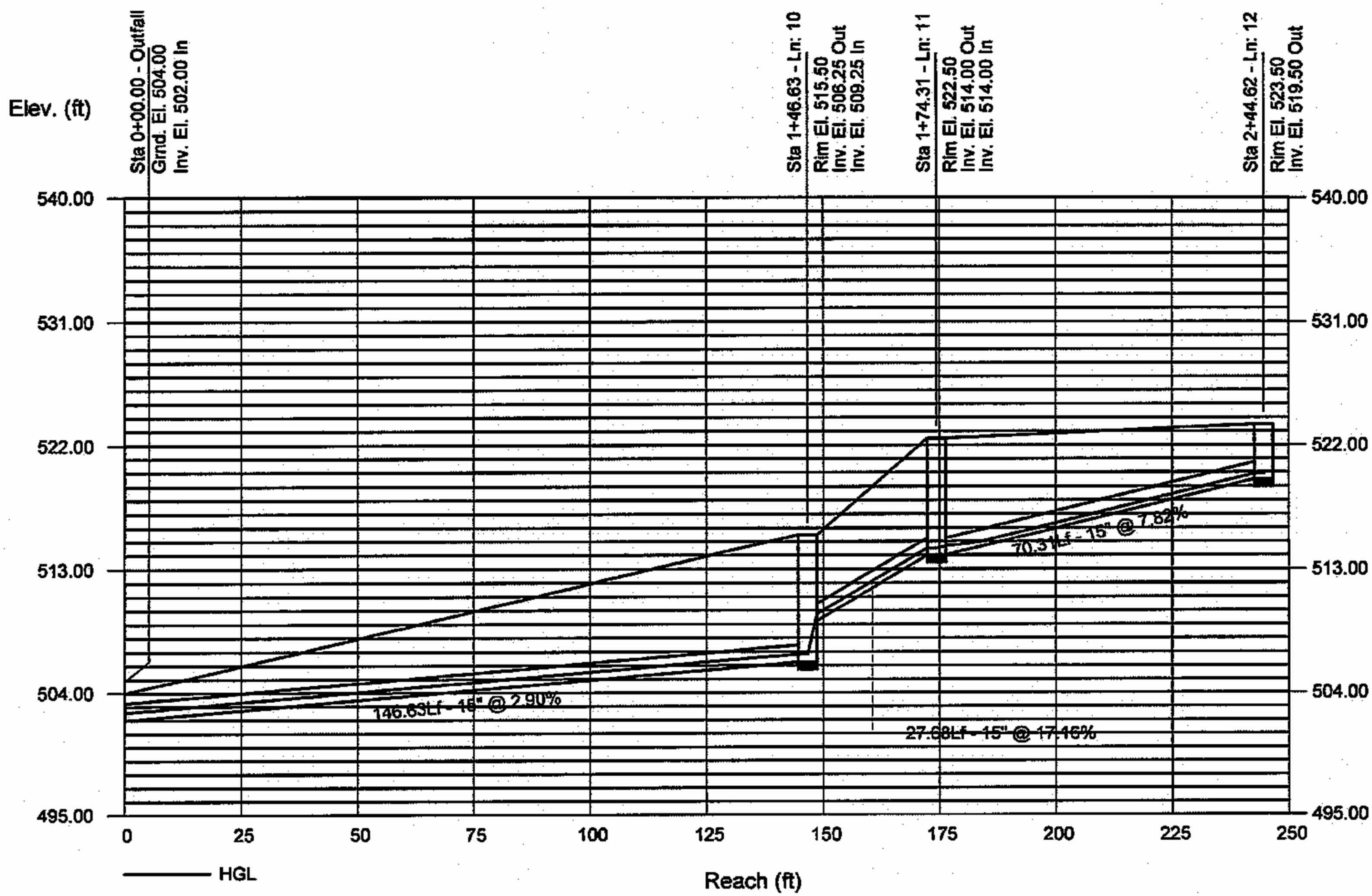

Storm Sewer Profile

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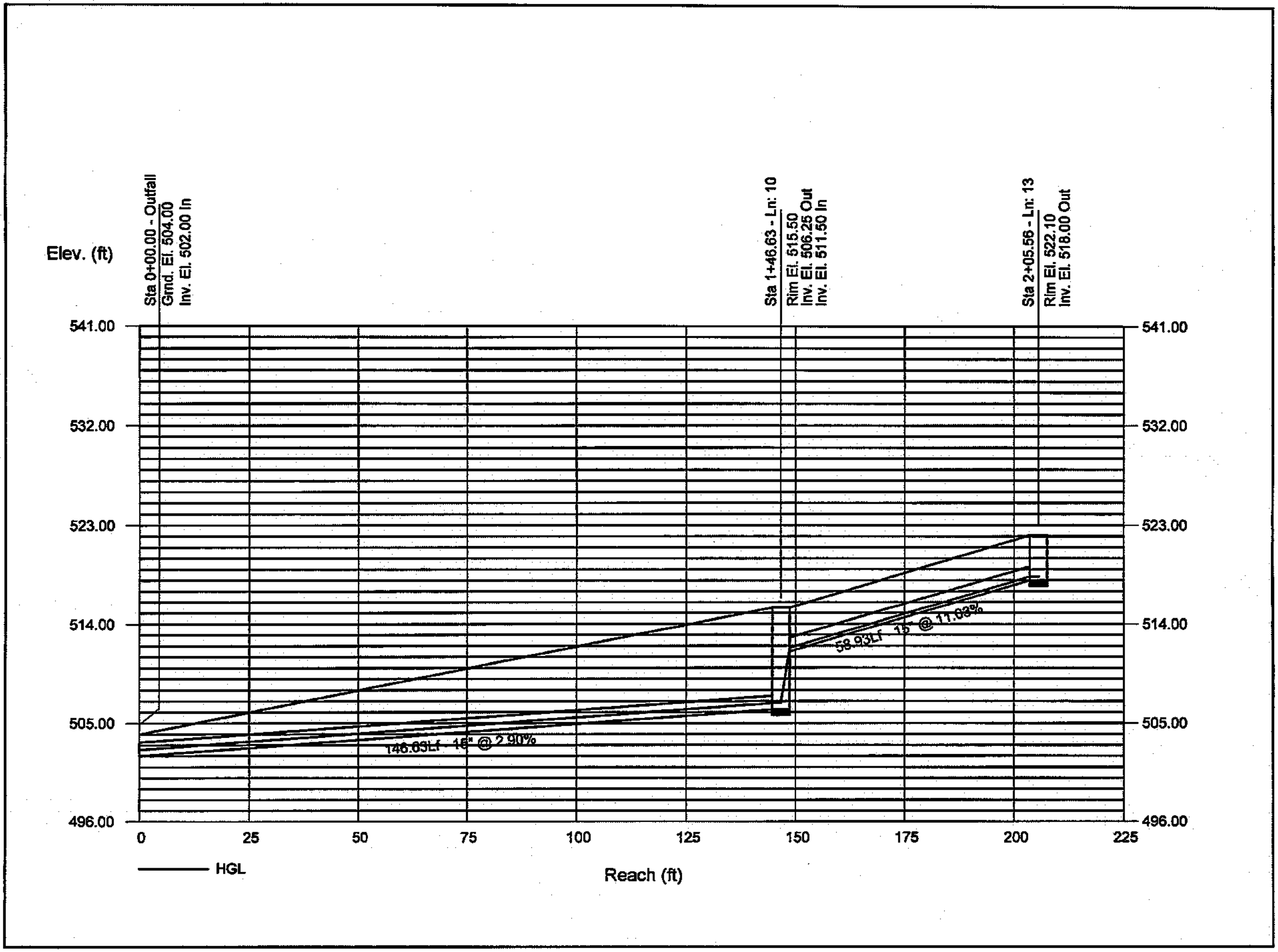

Storm Sewer Profile

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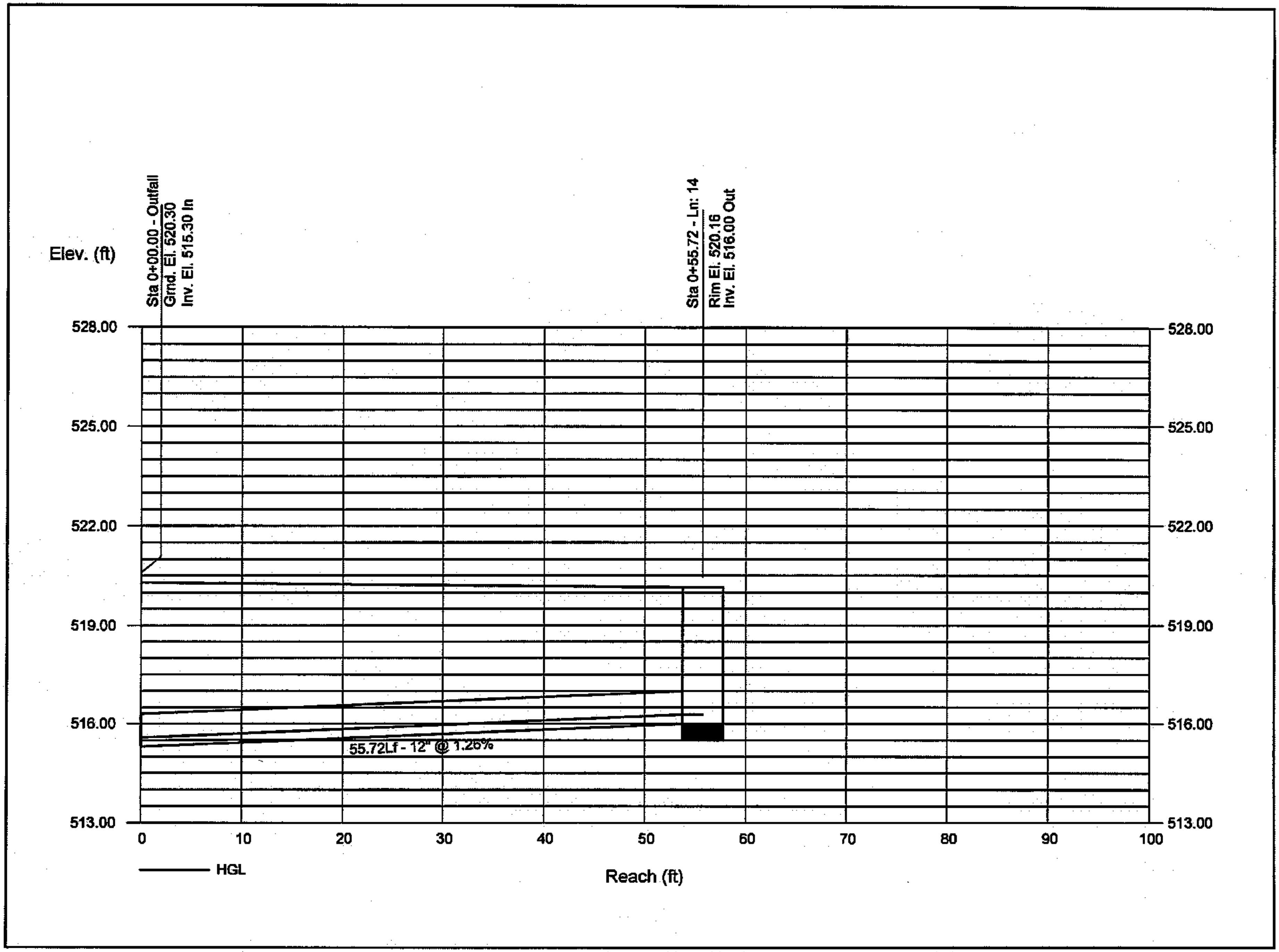
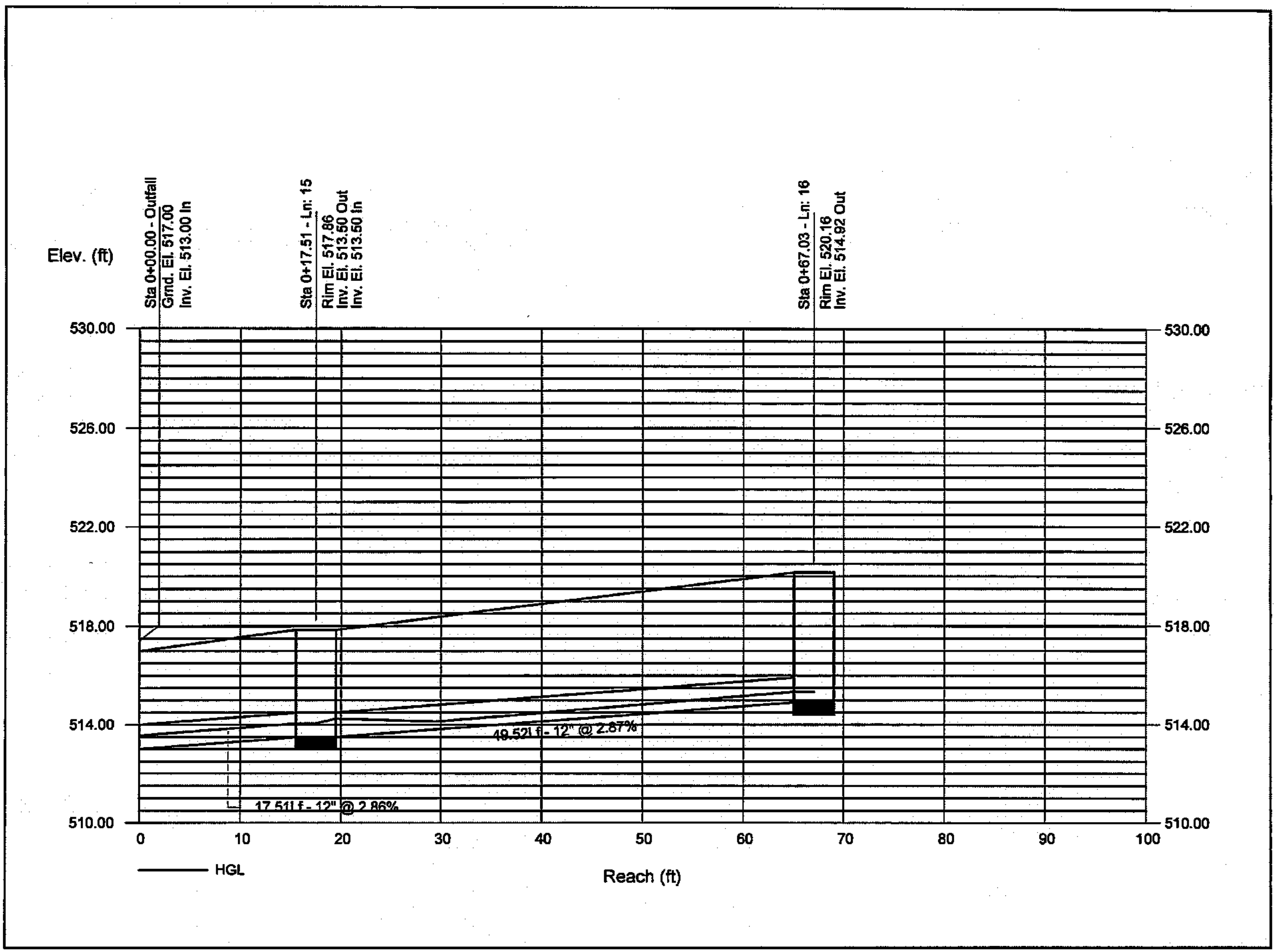


Hydraflow Storm Sewers 2008

Storm Sewer Profile

Proj. file: Taylor Mill Storm Sewers 100.stm



Hydraflow Storm Sewers 2008

Storm Sewer Profile

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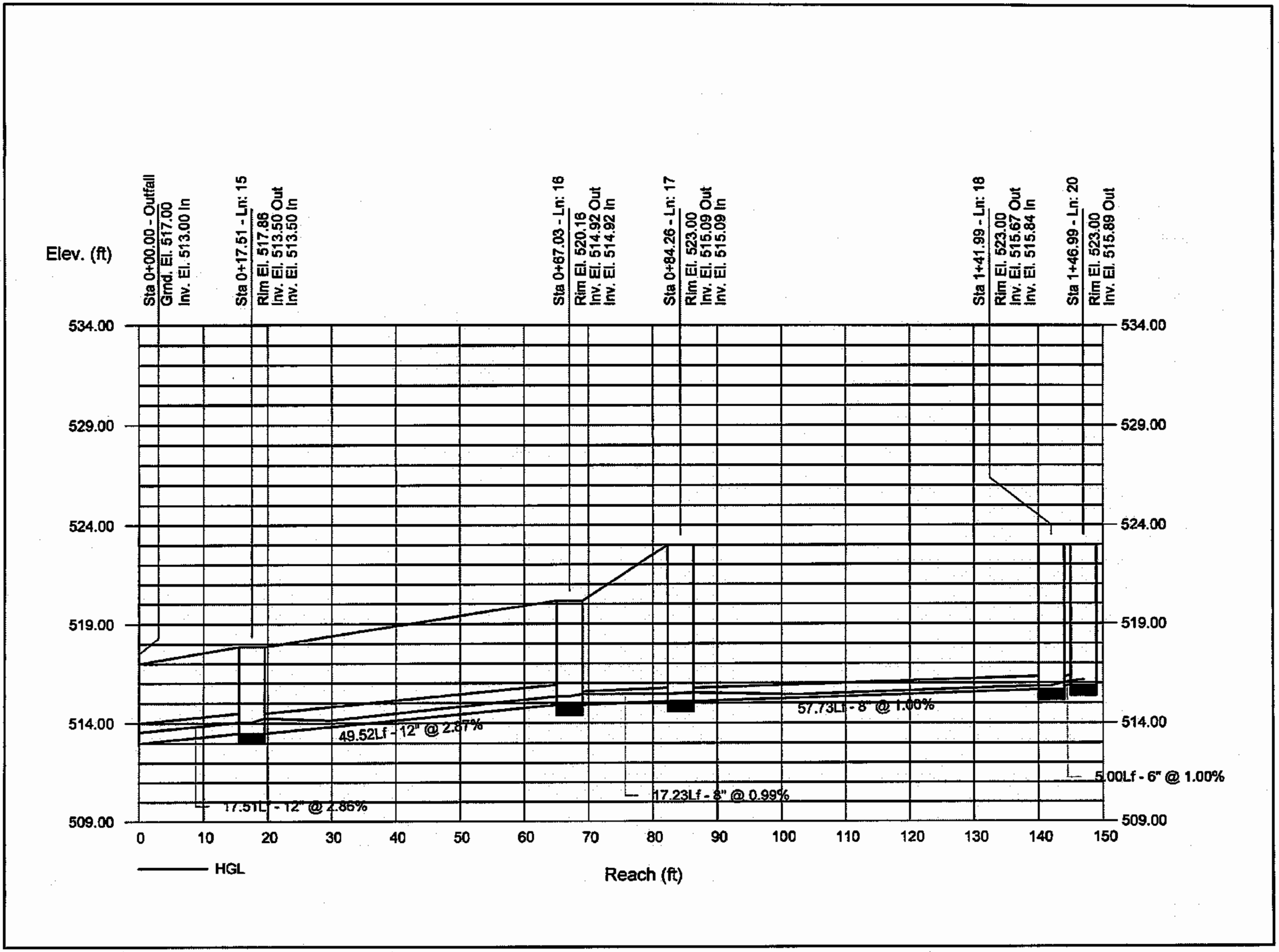
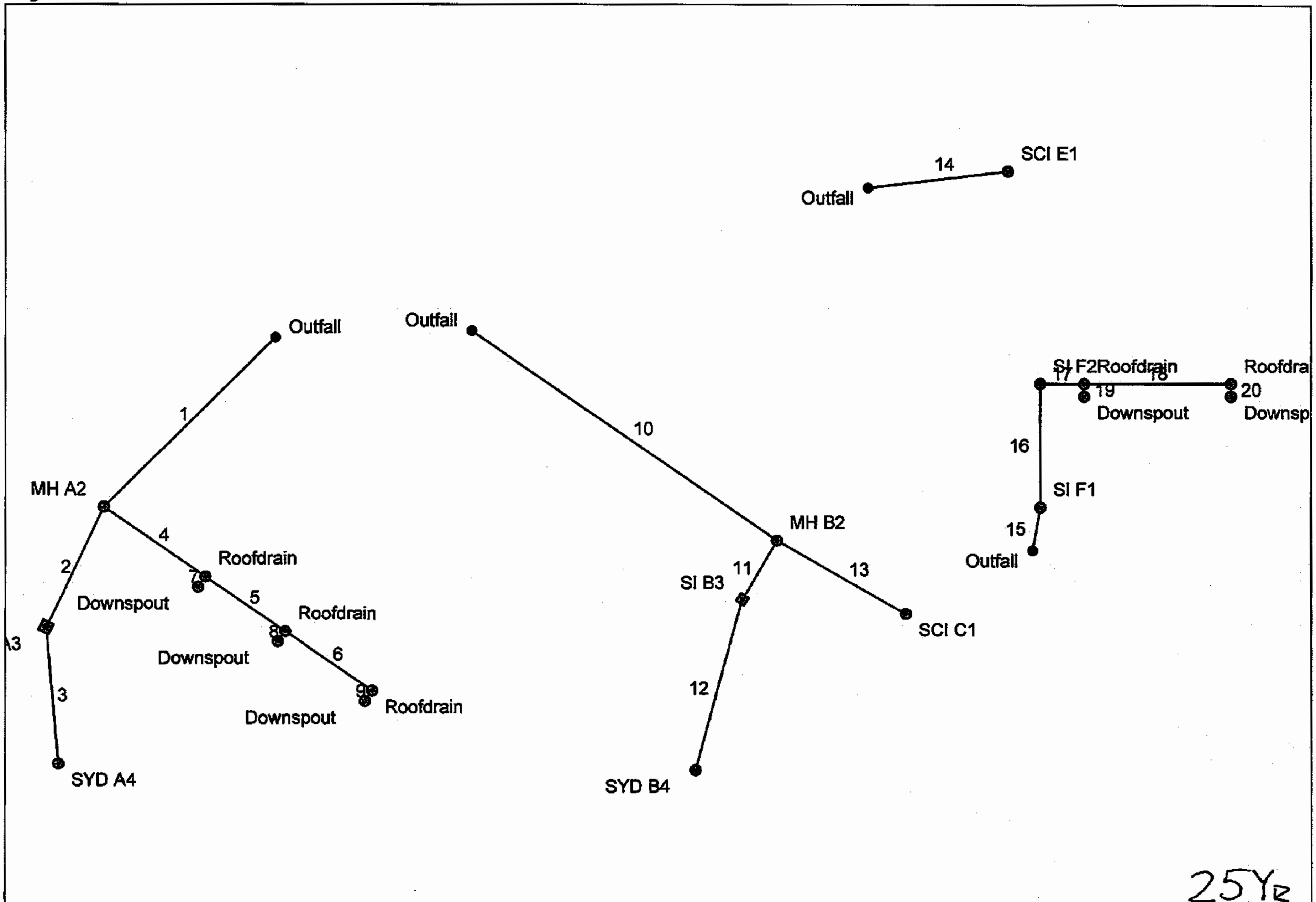


Hydraflow Storm Sewers 2008

Hydraflow Storm Sewers Plan



Project File: Taylor Mill Storm Sewers 100.stm	Number of lines: 20	Date: 10-11-2010

Hydraflow Storm Sewers 2008 v12.01

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	95.41	0.00	1.00	0.00	0.00	0.60	0.0	11.1	6.0	3.60	17.30	4.61	15	7.16	502.00	508.85	502.76	509.61	504.00	516.00	A Outfall
2	1	53.26	0.32	0.79	0.70	0.22	0.41	10.0	10.4	6.1	2.53	19.78	3.19	15	9.38	508.85	513.85	509.87	514.49	516.00	522.20	A
3	2	54.74	0.47	0.47	0.40	0.19	0.19	10.0	10.0	6.3	1.18	18.82	2.19	15	8.49	513.85	518.50	514.72	518.93	522.20	522.50	A
4	1	48.59	0.00	0.21	0.00	0.00	0.19	0.0	10.7	6.1	1.15	3.58	2.53	12	1.01	509.13	509.62	509.91	510.07	516.00	518.00	Roofdrain
5	4	38.52	0.00	0.14	0.00	0.00	0.13	0.0	10.4	6.1	0.77	3.58	2.22	12	1.01	509.62	510.01	510.23	510.38	518.00	518.00	Roofdrain
6	5	41.94	0.00	0.07	0.00	0.00	0.06	0.0	10.0	6.2	0.39	3.56	1.68	12	1.00	510.01	510.43	510.51	510.70	518.00	518.00	Roofdrain
7	4	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	6.3	0.39	0.56	2.97	6	1.00	510.12	510.17	510.44	510.49	518.00	518.00	Downspout
8	5	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	6.3	0.39	0.56	2.97	6	1.00	510.51	510.56	510.83	510.88	518.00	518.00	Downspout
9	6	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	6.3	0.39	0.56	2.97	6	1.00	510.93	510.98	511.25	511.30	518.00	518.00	Downspout
10	End	146.63	0.00	0.70	0.00	0.00	0.41	0.0	10.6	6.1	2.47	10.99	3.99	15	2.90	502.00	506.25	502.63	506.88	504.00	515.50	B Outfall
11	10	27.68	0.12	0.58	0.90	0.11	0.29	10.0	10.5	6.1	1.79	26.75	3.56	15	17.16	509.25	514.00	509.79	514.54	515.50	522.50	B
12	11	70.31	0.46	0.46	0.40	0.18	0.18	10.0	10.0	6.3	1.15	18.06	2.33	15	7.82	514.00	519.50	514.72	519.93	522.50	523.50	B
13	10	58.93	0.12	0.12	0.95	0.11	0.11	10.0	10.0	6.3	0.71	21.45	2.66	15	11.03	511.50	518.00	511.84	518.34	515.50	522.10	C
14	End	55.72	0.13	0.13	0.60	0.08	0.08	10.0	10.0	6.3	0.49	3.99	2.51	12	1.26	515.30	516.00	515.60	516.30	520.30	520.16	E Outfall
15	End	17.51	0.16	0.38	0.85	0.14	0.33	10.0	11.3	5.9	1.93	6.02	4.01	12	2.86	513.00	513.50	513.59	514.09	517.00	517.86	F Outfall
16	15	49.52	0.16	0.22	0.85	0.14	0.19	10.0	11.0	6.0	1.14	6.03	2.49	12	2.87	513.50	514.92	514.31	515.37	517.86	520.16	F
17	16	17.23	0.00	0.06	0.00	0.00	0.05	0.0	10.8	6.1	0.33	1.20	1.23	8	0.99	514.92	515.09	515.50	515.50	520.16	523.00	Roofdrain
18	17	57.73	0.00	0.03	0.00	0.00	0.03	0.0	10.0	6.2	0.17	1.21	1.32	8	1.00	515.09	515.67	515.56	515.86	523.00	523.00	Roofdrain
19	17	5.00	0.03	0.03	0.90	0.03	0.03	10.0	10.0	6.3	0.17	0.56	1.60	6	1.00	515.26	515.31	515.56	515.55	523.00	523.00	Downspout
20	18	5.00	0.03	0.03	0.90	0.03	0.03	10.0	10.0	6.3	0.17	0.56	2.17	6	1.00	515.84	515.89	516.05	516.10	523.00	523.00	Downspout

Project File: Taylor Mill Storm Sewers 100.stm | Number of lines: 20 | Run Date: 10-11-2010

NOTES: Intensity = 50.50 / (Inlet time + 7.30) ^ 0.73; Return period = 25 Yrs. ; c = cir e = ellip b = box

Inlet Report

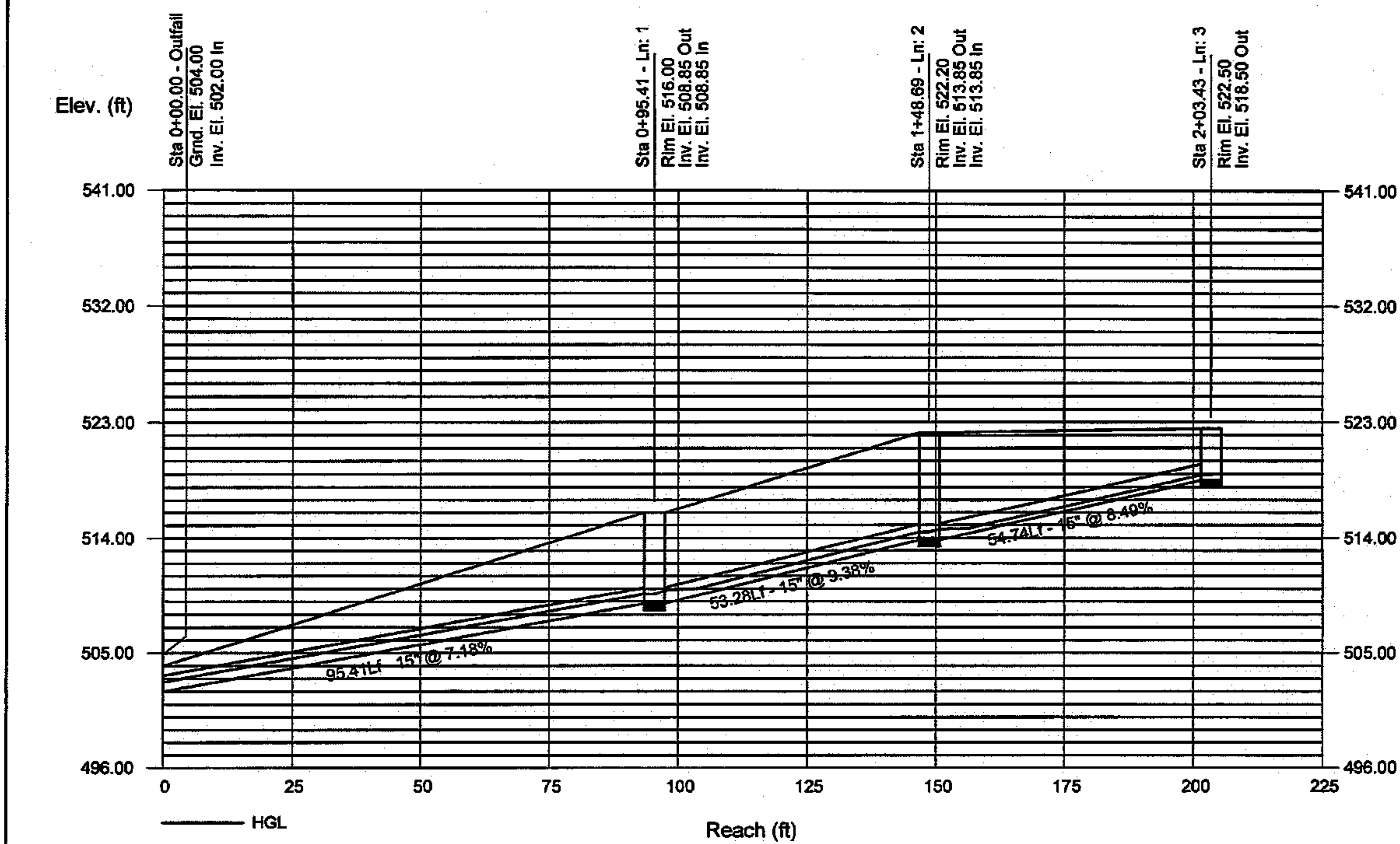
Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH A2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	SCI A3	1.40	0.00	1.40	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.19	6.50	0.19	6.50	0.0	Off
3	SYD A4	1.18	0.00	1.18	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.13	15.37	0.13	15.37	0.0	Off
4	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
5	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
6	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
7	Downspout	0.39	0.00	0.39	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.06	8.45	0.06	8.45	0.0	Off
8	Downspout	0.39	0.00	0.39	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.06	8.45	0.06	8.45	0.0	Off
9	Downspout	0.39	0.00	0.39	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.06	8.45	0.06	8.45	0.0	Off
10	MH B2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
11	SI B3	0.68	0.00	0.68	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.09	11.24	0.09	11.24	0.0	Off
12	SYD B4	1.15	0.00	1.15	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.13	15.18	0.13	15.18	0.0	Off
13	SCI C1	0.71	0.00	0.71	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.12	3.00	0.12	3.00	0.0	Off
14	SCI E1	0.49	0.00	0.49	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.10	2.00	0.10	2.00	0.0	Off
15	SI F1	0.85	0.00	0.85	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.11	12.77	0.11	12.77	0.0	Off
16	SI F2	0.85	0.00	0.85	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.11	12.77	0.11	12.77	0.0	Off
17	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
18	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
19	Downspout	0.17	0.00	0.17	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.04	5.66	0.04	5.66	0.0	Off
20	Downspout	0.17	0.00	0.17	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.04	5.66	0.04	5.66	0.0	Off

Project File: Taylor Mill Storm Sewers 100.stm | Number of lines: 20 | Run Date: 10-11-2010

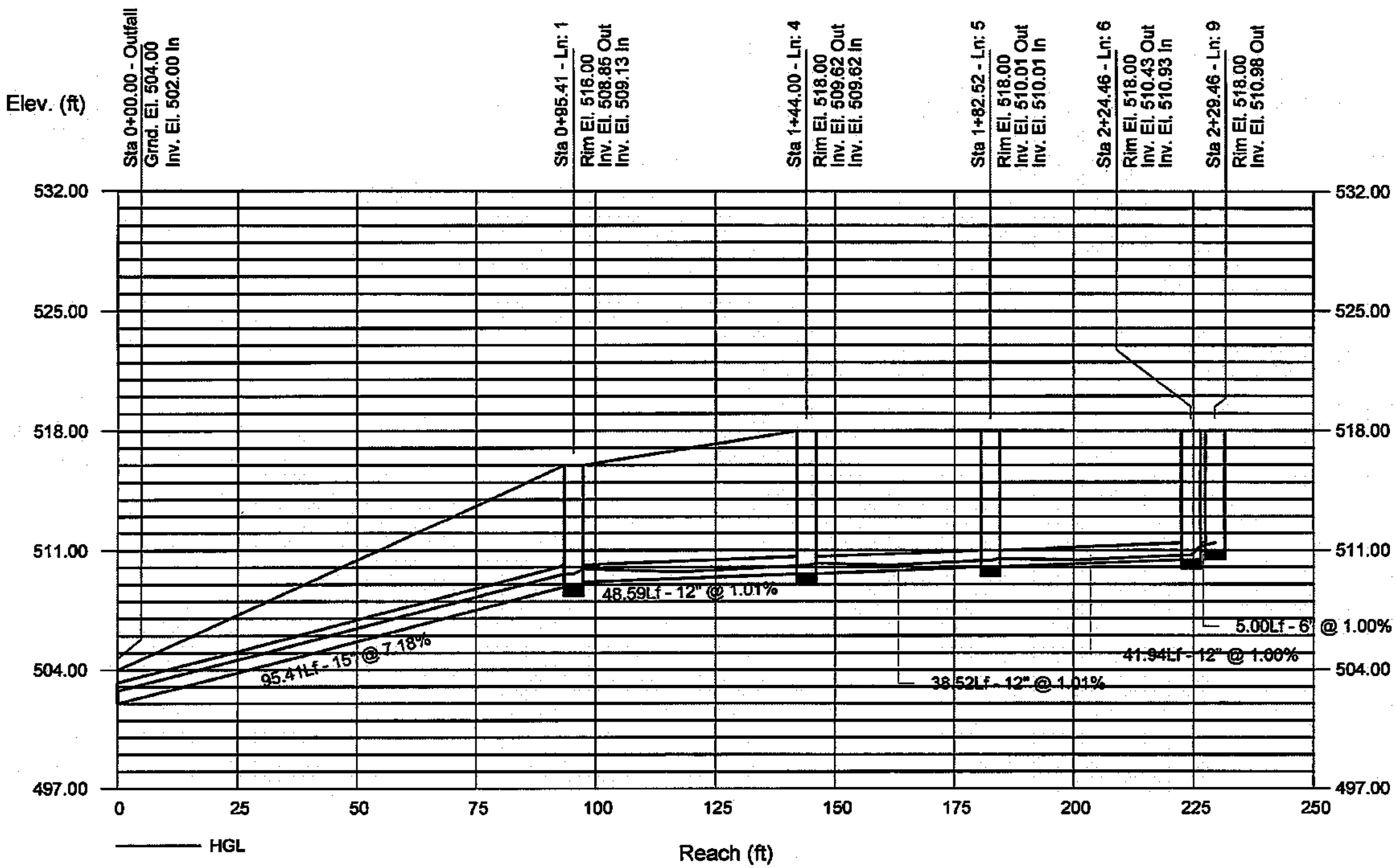
NOTES: Inlet N-Values = 0.016 ; Intensity = 50.50 / (Inlet time + 7.30) ^ 0.73; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Storm Sewer Profile

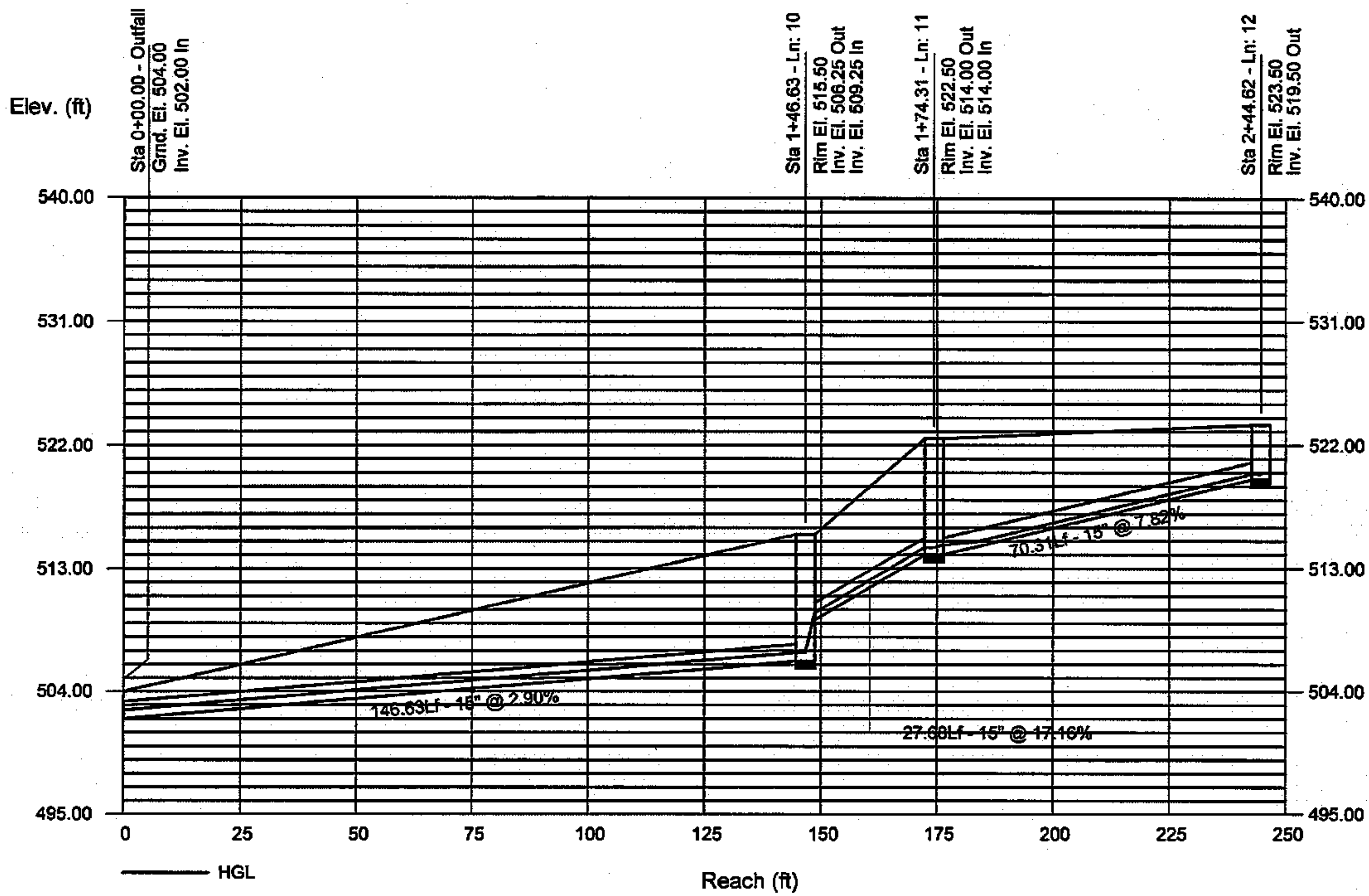
Proj. file: Taylor Mill Storm Sewers 100.stm



Storm Sewer Profile



Storm Sewer Profile



Storm Sewer Profile

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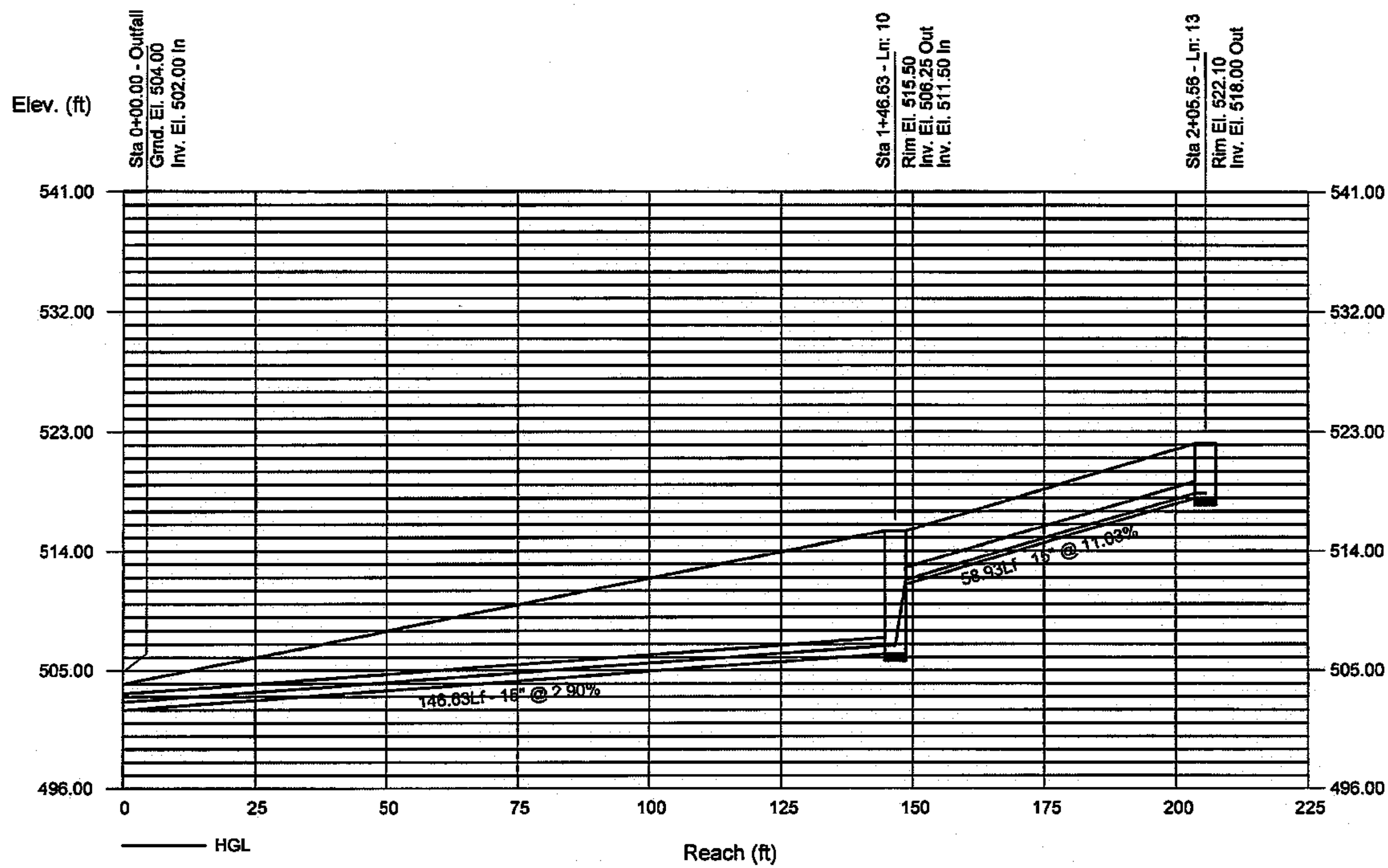

Storm Sewer Profile

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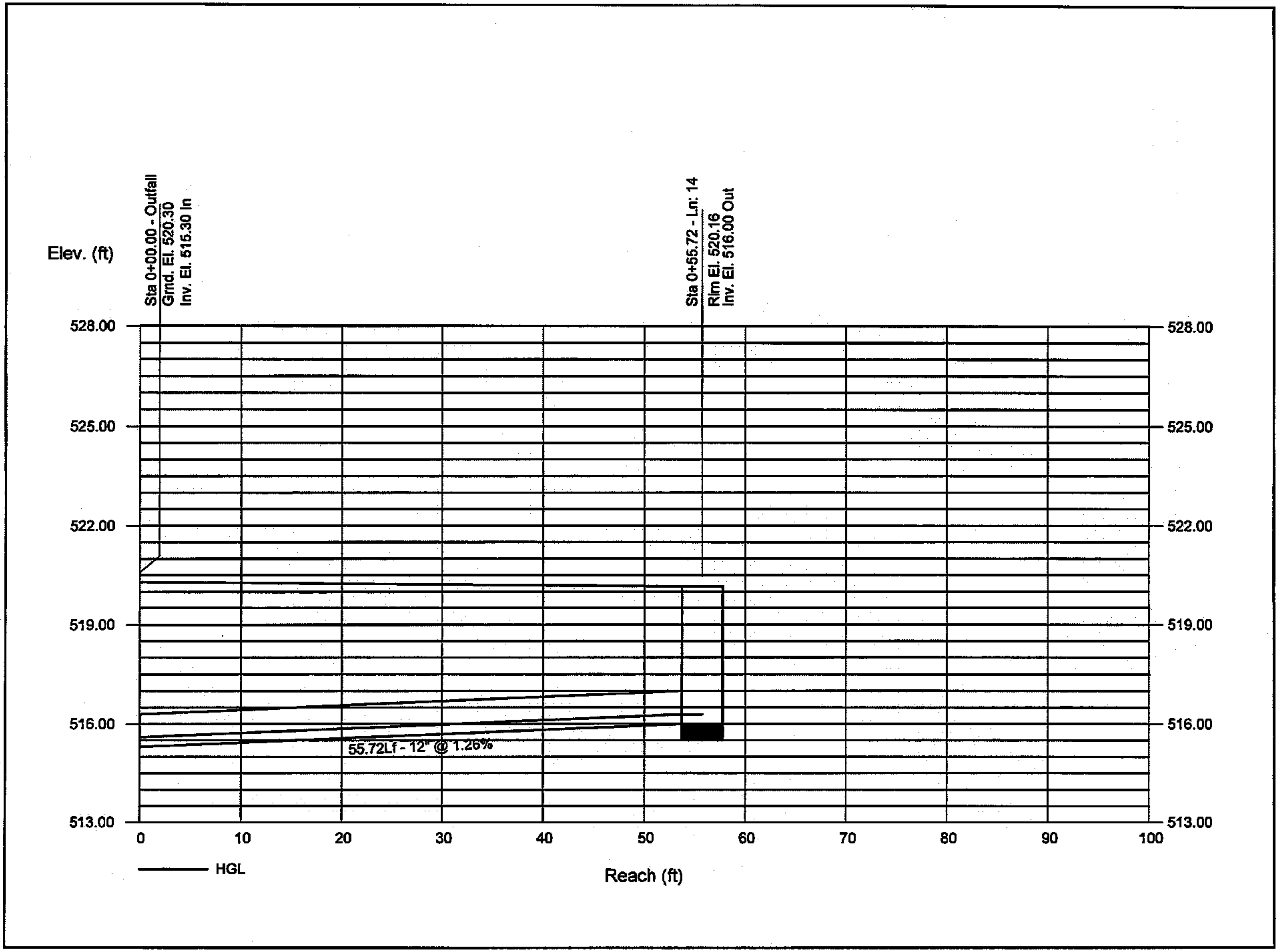

Storm Sewer Profile

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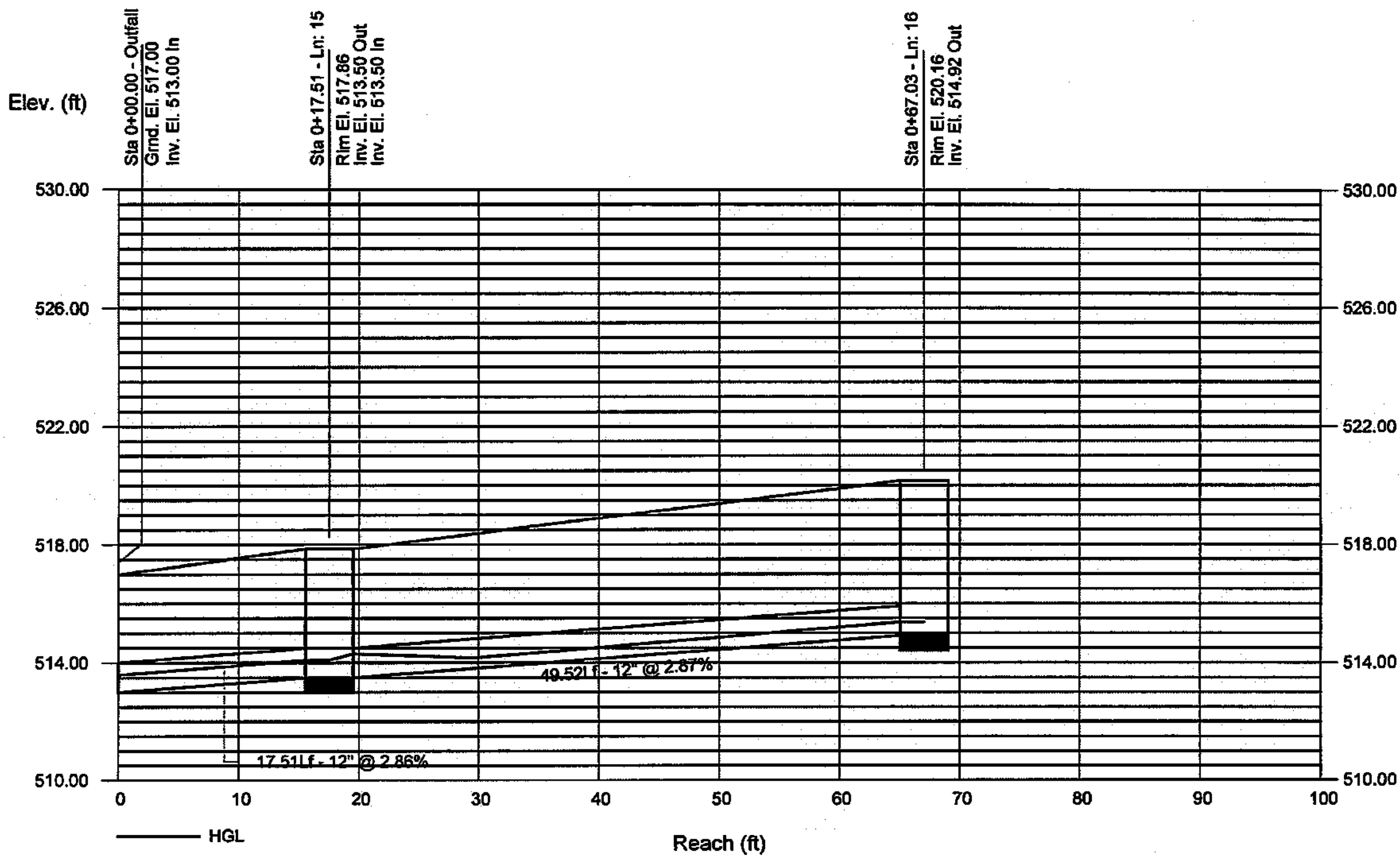
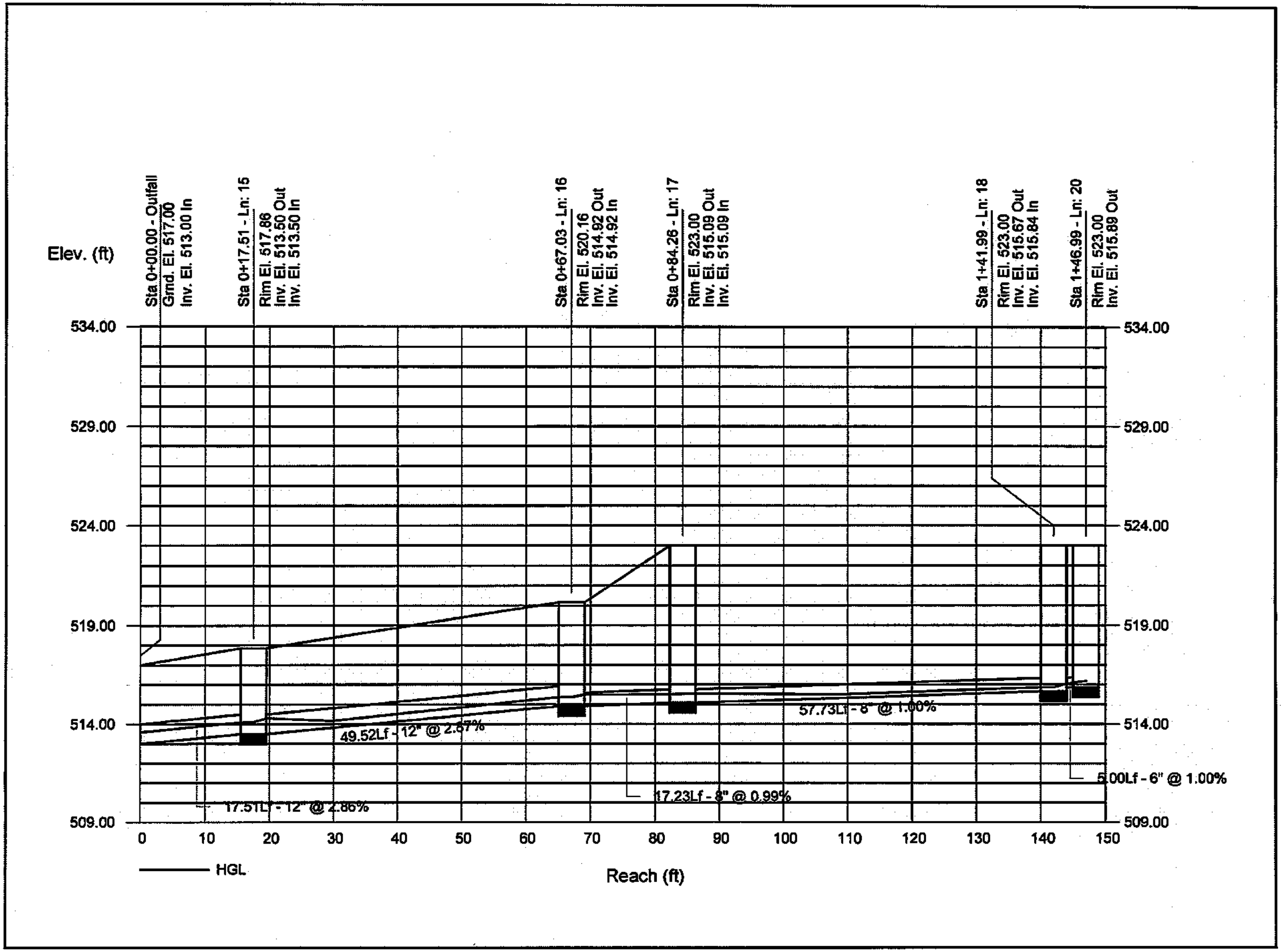


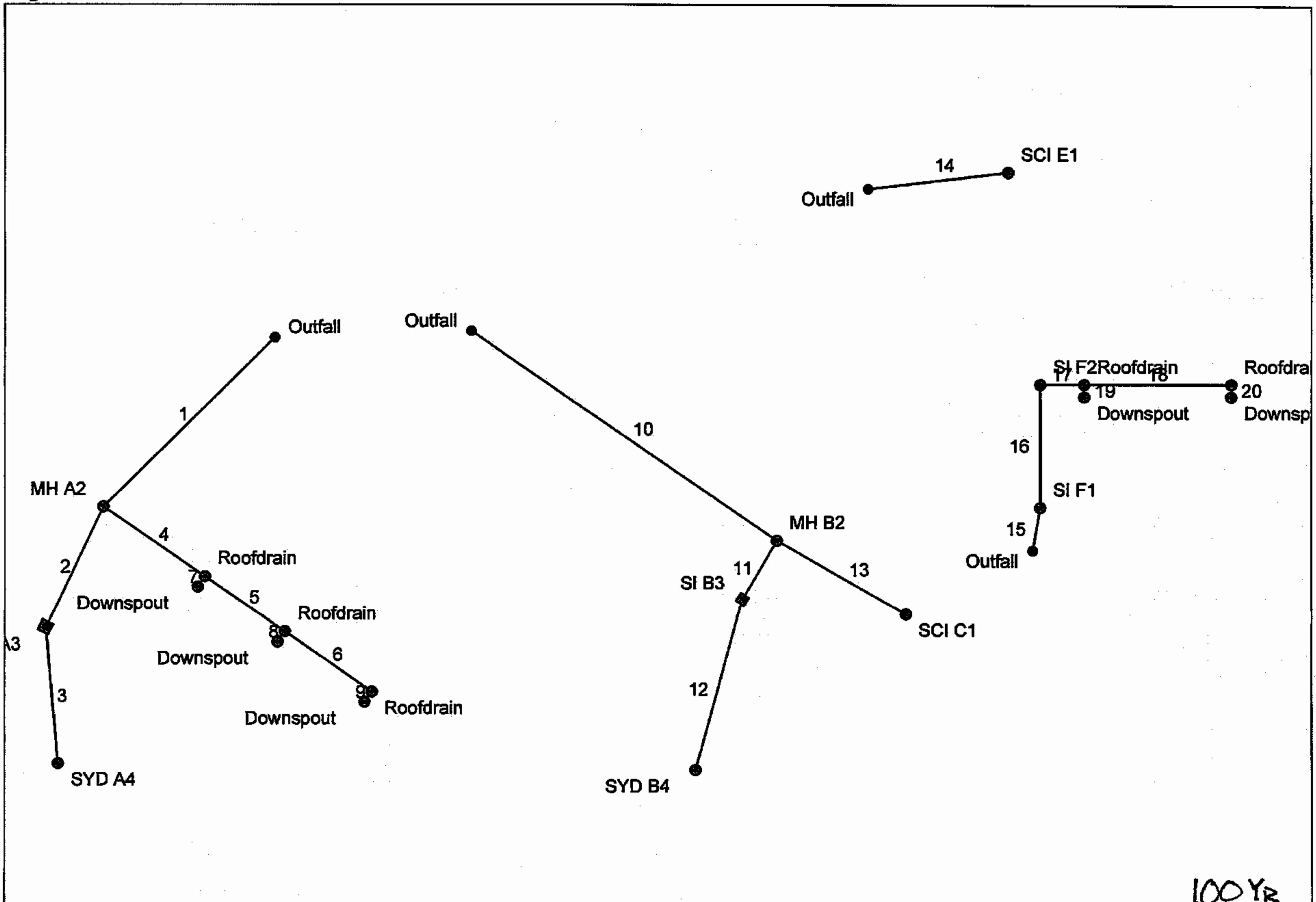
Hydraflow Storm Sewers 2008

Storm Sewer Profile

Proj. file: Taylor Mill Storm Sewers 100.stm



Hydraflow Storm Sewers Plan



Project File: Taylor Mill Storm Sewers 100.stm	Number of lines: 20	Date: 10-11-2010

Hydraflow Storm Sewers 2008 v12.01

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	95.41	0.00	1.00	0.00	0.00	0.60	0.0	11.0	7.0	4.19	17.30	4.92	15	7.18	502.00	508.85	502.82	509.67	504.00	516.00	A Outfall
2	1	53.28	0.32	0.79	0.70	0.22	0.41	10.0	10.4	7.1	2.94	19.78	3.41	15	9.38	508.85	513.85	509.96	514.54	516.00	522.20	A
3	2	54.74	0.47	0.47	0.40	0.19	0.19	10.0	10.0	7.3	1.37	18.82	2.31	15	8.49	513.85	518.50	514.80	518.97	522.20	522.50	A
4	1	48.59	0.00	0.21	0.00	0.00	0.19	0.0	10.7	7.1	1.33	3.58	2.66	12	1.01	509.13	509.62	510.00	510.11	516.00	518.00	Roofdrain
5	4	38.52	0.00	0.14	0.00	0.00	0.13	0.0	10.4	7.1	0.90	3.58	2.34	12	1.01	509.62	510.01	510.28	510.41	518.00	518.00	Roofdrain
6	5	41.94	0.00	0.07	0.00	0.00	0.06	0.0	10.0	7.3	0.46	3.56	1.76	12	1.00	510.01	510.43	510.55	510.72	518.00	518.00	Roofdrain
7	4	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	7.3	0.46	0.56	3.18	6	1.00	510.12	510.17	510.46	510.51	518.00	518.00	Downspout
8	5	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	7.3	0.46	0.56	3.18	6	1.00	510.51	510.56	510.85	510.90	518.00	518.00	Downspout
9	6	5.00	0.07	0.07	0.90	0.06	0.06	10.0	10.0	7.3	0.46	0.56	3.18	6	1.00	510.93	510.98	511.27	511.32	518.00	518.00	Downspout
10	End	146.63	0.00	0.70	0.00	0.00	0.41	0.0	10.6	7.1	2.88	10.99	4.23	15	2.90	502.00	506.25	502.68	506.93	504.00	515.50	B Outfall
11	10	27.68	0.12	0.58	0.90	0.11	0.29	10.0	10.5	7.1	2.08	26.75	3.75	15	17.16	509.25	514.00	509.83	514.58	515.50	522.50	B
12	11	70.31	0.46	0.46	0.40	0.18	0.18	10.0	10.0	7.3	1.34	18.06	2.45	15	7.82	514.00	519.50	514.78	519.96	522.50	523.50	B
13	10	58.93	0.12	0.12	0.95	0.11	0.11	10.0	10.0	7.3	0.83	21.45	2.79	15	11.03	511.50	518.00	511.86	518.36	515.50	522.10	C
14	End	55.72	0.13	0.13	0.60	0.08	0.08	10.0	10.0	7.3	0.57	3.99	2.62	12	1.26	515.30	516.00	515.62	516.32	520.30	520.16	E Outfall
15	End	17.51	0.16	0.38	0.85	0.14	0.33	10.0	11.3	6.9	2.25	6.02	4.27	12	2.86	513.00	513.50	513.64	514.14	517.00	517.86	F Outfall
16	15	49.52	0.16	0.22	0.85	0.14	0.19	10.0	11.0	7.0	1.33	6.03	2.65	12	2.87	513.50	514.92	514.37	515.41	517.86	520.16	F
17	16	17.23	0.00	0.06	0.00	0.00	0.05	0.0	10.7	7.0	0.38	1.20	1.28	8	0.99	514.92	515.09	515.55	515.56	520.16	523.00	Roofdrain
18	17	57.73	0.00	0.03	0.00	0.00	0.03	0.0	10.0	7.3	0.20	1.21	1.38	8	1.00	515.09	515.67	515.62	515.88	523.00	523.00	Roofdrain
19	17	5.00	0.03	0.03	0.90	0.03	0.03	10.0	10.0	7.3	0.20	0.56	1.57	6	1.00	515.26	515.31	515.59	515.59	523.00	523.00	Downspout
20	18	5.00	0.03	0.03	0.90	0.03	0.03	10.0	10.0	7.3	0.20	0.56	2.28	6	1.00	515.84	515.89	516.06	516.12	523.00	523.00	Downspout

Project File: Taylor Mill Storm Sewers 100.stm | Number of lines: 20 | Run Date: 10-11-2010

NOTES: Intensity = 44.82 / (Inlet time + 5.70) ^ 0.66; Return period = 100 Yrs. ; c = cir e = ellip b = box

Inlet Report

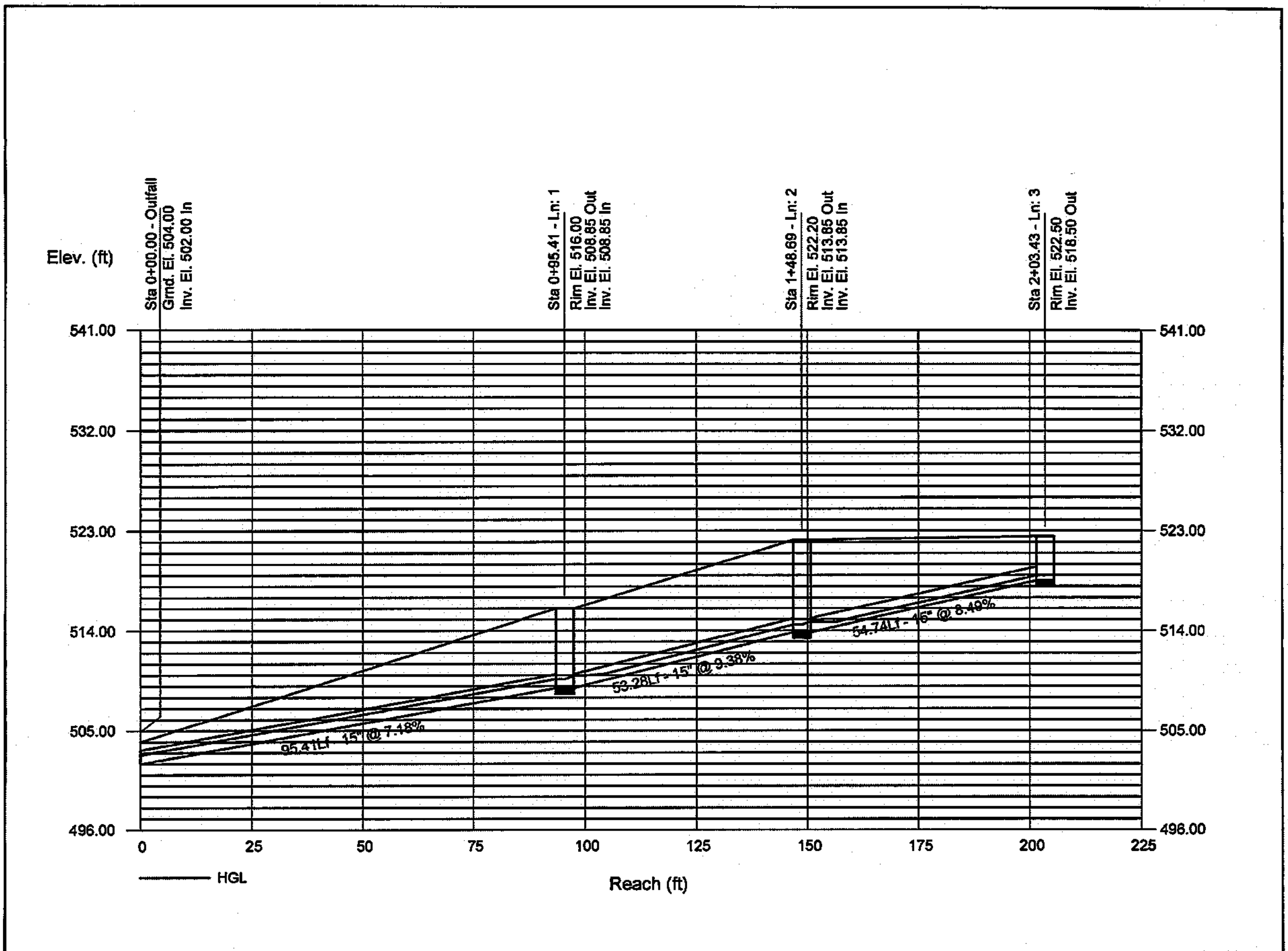
Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH A2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	SCI A3	1.63	0.00	1.63	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.21	7.50	0.21	7.50	0.0	Off
3	SYD A4	1.37	0.00	1.37	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.15	16.78	0.15	16.78	0.0	Off
4	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
5	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
6	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
7	Downspout	0.46	0.00	0.46	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.07	9.13	0.07	9.13	0.0	Off
8	Downspout	0.46	0.00	0.46	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.07	9.13	0.07	9.13	0.0	Off
9	Downspout	0.46	0.00	0.46	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.07	9.13	0.07	9.13	0.0	Off
10	MH B2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
11	SI B3	0.78	0.00	0.78	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.10	12.21	0.10	12.21	0.0	Off
12	SYD B4	1.34	0.00	1.34	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.15	16.57	0.15	16.57	0.0	Off
13	SCI C1	0.83	0.00	0.83	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.13	3.50	0.13	3.50	0.0	Off
14	SCI E1	0.57	0.00	0.57	0.00	Comb	4.0	2.00	4.00	2.00	2.00	Sag	2.00	0.050	0.020	0.000	0.10	2.00	0.10	2.00	0.0	Off
15	SI F1	0.99	0.00	0.99	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.12	13.91	0.12	13.91	0.0	Off
16	SI F2	0.99	0.00	0.99	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.12	13.91	0.12	13.91	0.0	Off
17	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
18	Roofdrain	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
19	Downspout	0.20	0.00	0.20	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.04	6.05	0.04	6.05	0.0	Off
20	Downspout	0.20	0.00	0.20	0.00	DrGrt	0.0	0.00	2.00	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.04	6.05	0.04	6.05	0.0	Off

Project File: Taylor Mill Storm Sewers 100.stm | Number of lines: 20 | Run Date: 10-11-2010

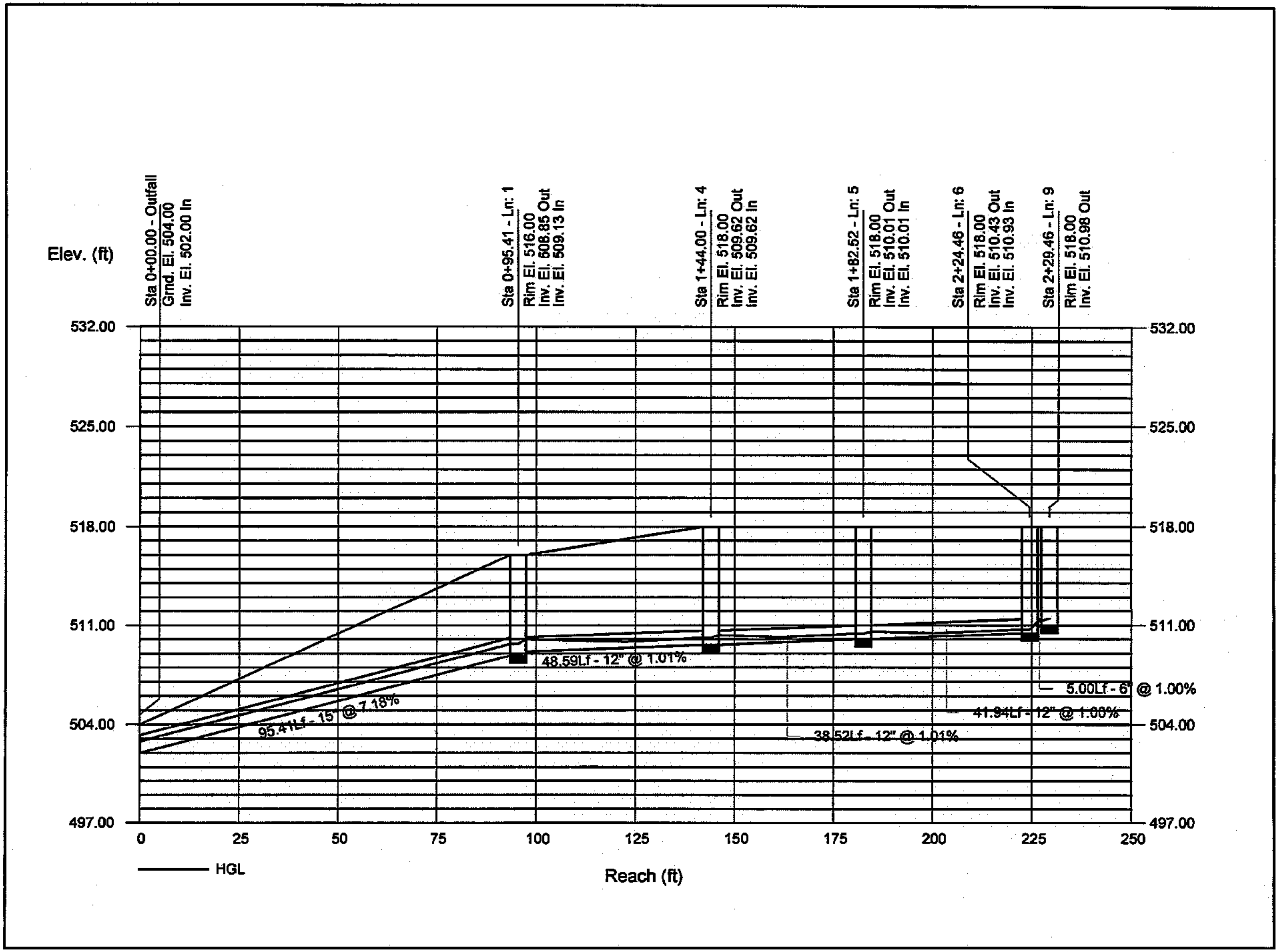
NOTES: Inlet N-Values = 0.016 ; Intensity = 44.82 / (Inlet time + 5.70) ^ 0.66; Return period = 100 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Storm Sewer Profile

Proj. file: Taylor Mill Storm Sewers 100.stm

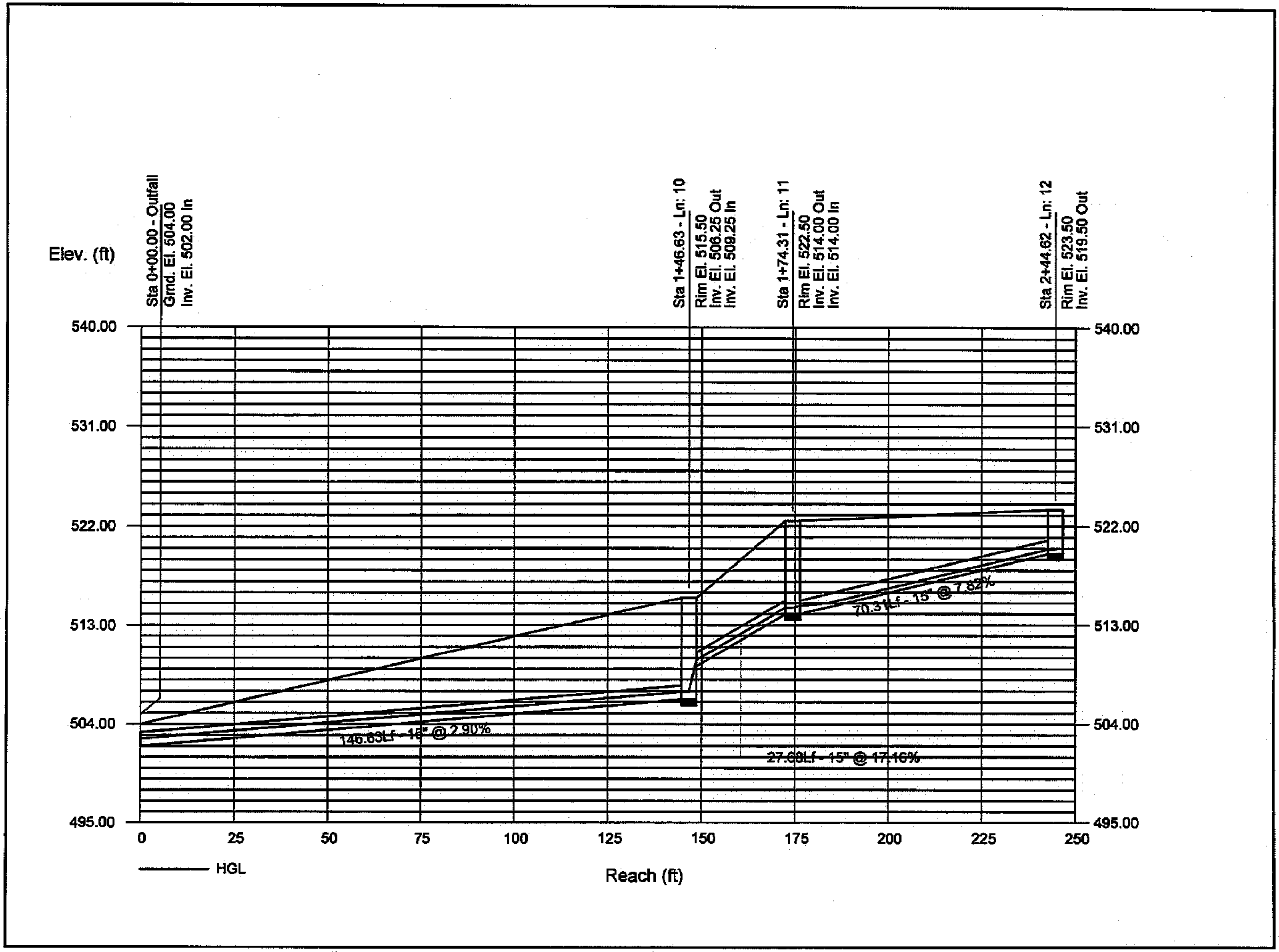


Storm Sewer Profile



Storm Sewer Profile

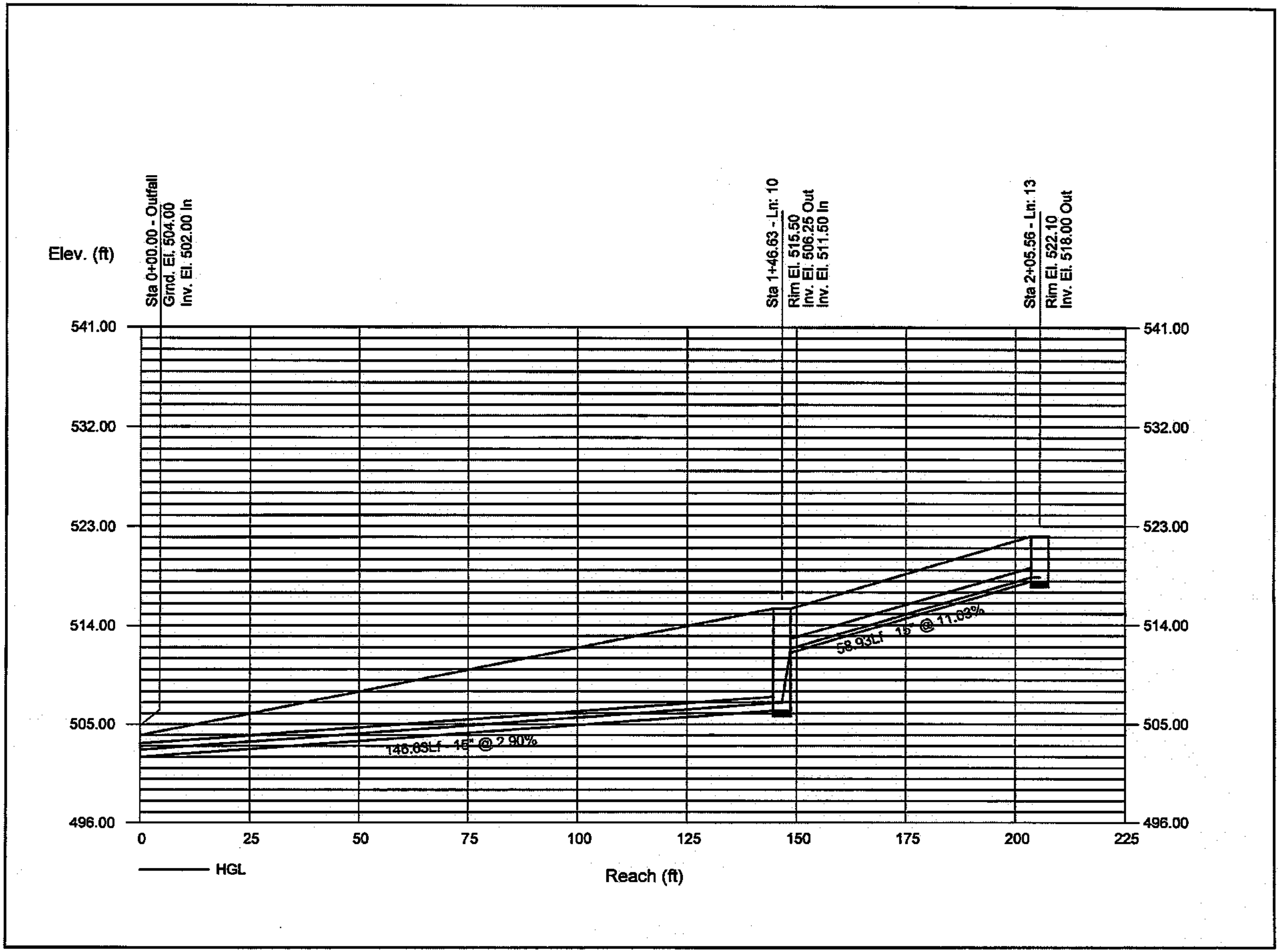
Proj. file: Taylor Mill Storm Sewers 100.stm



Hydraflow Storm Sewers 2008

Storm Sewer Profile

Proj. file: Taylor Mill Storm Sewers 100.stm



Hydraflow Storm Sewers 2008

Storm Sewer Profile

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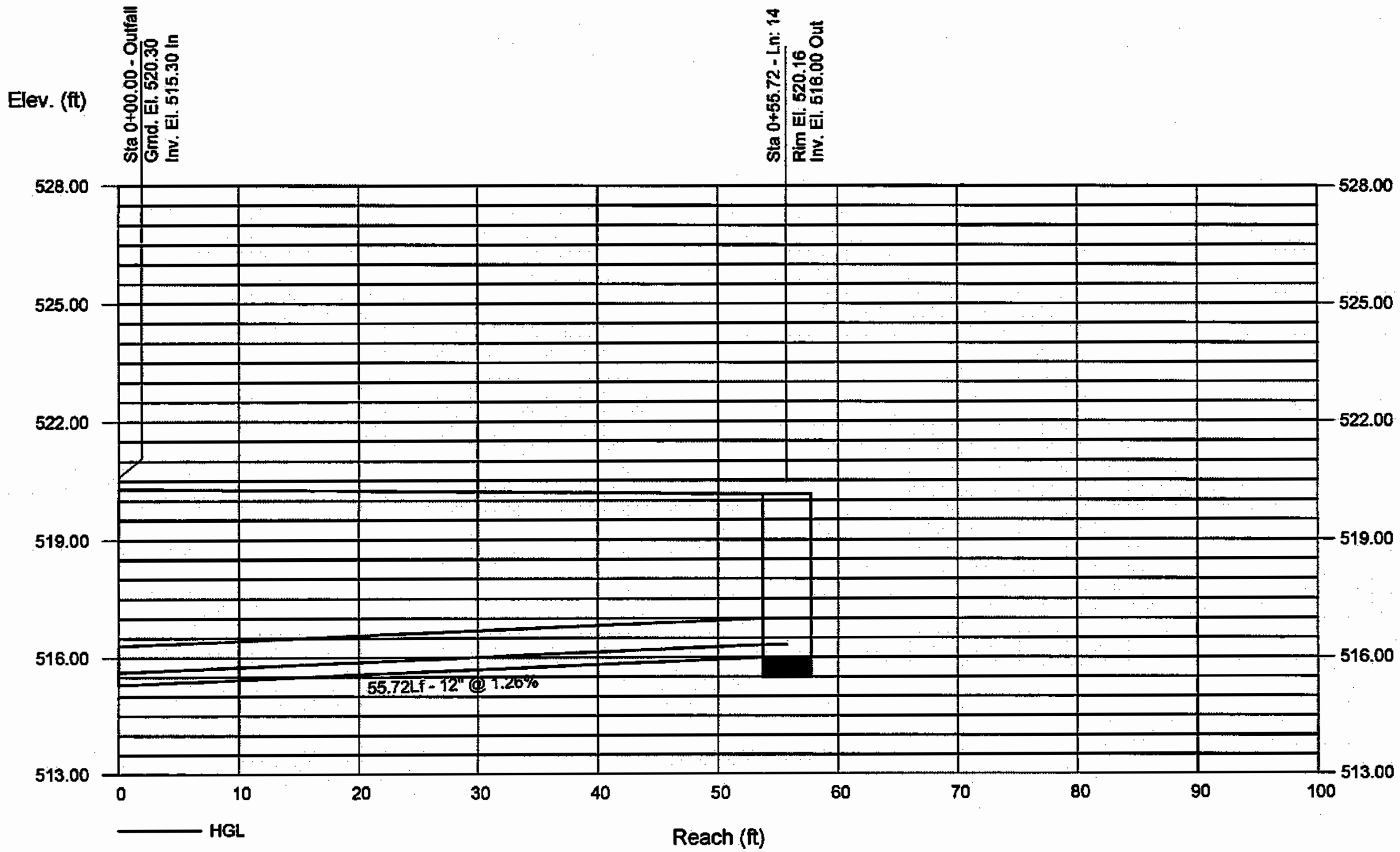
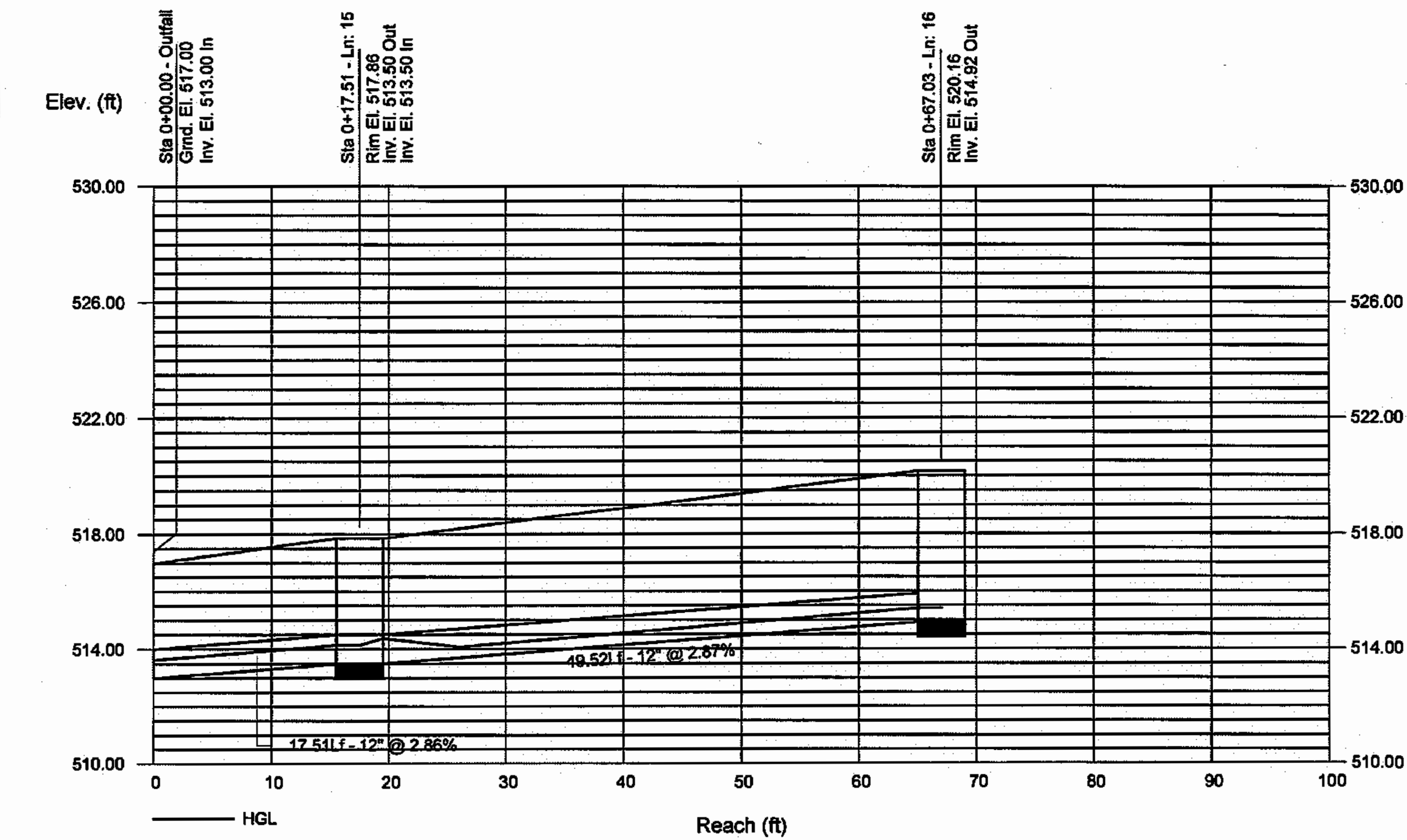


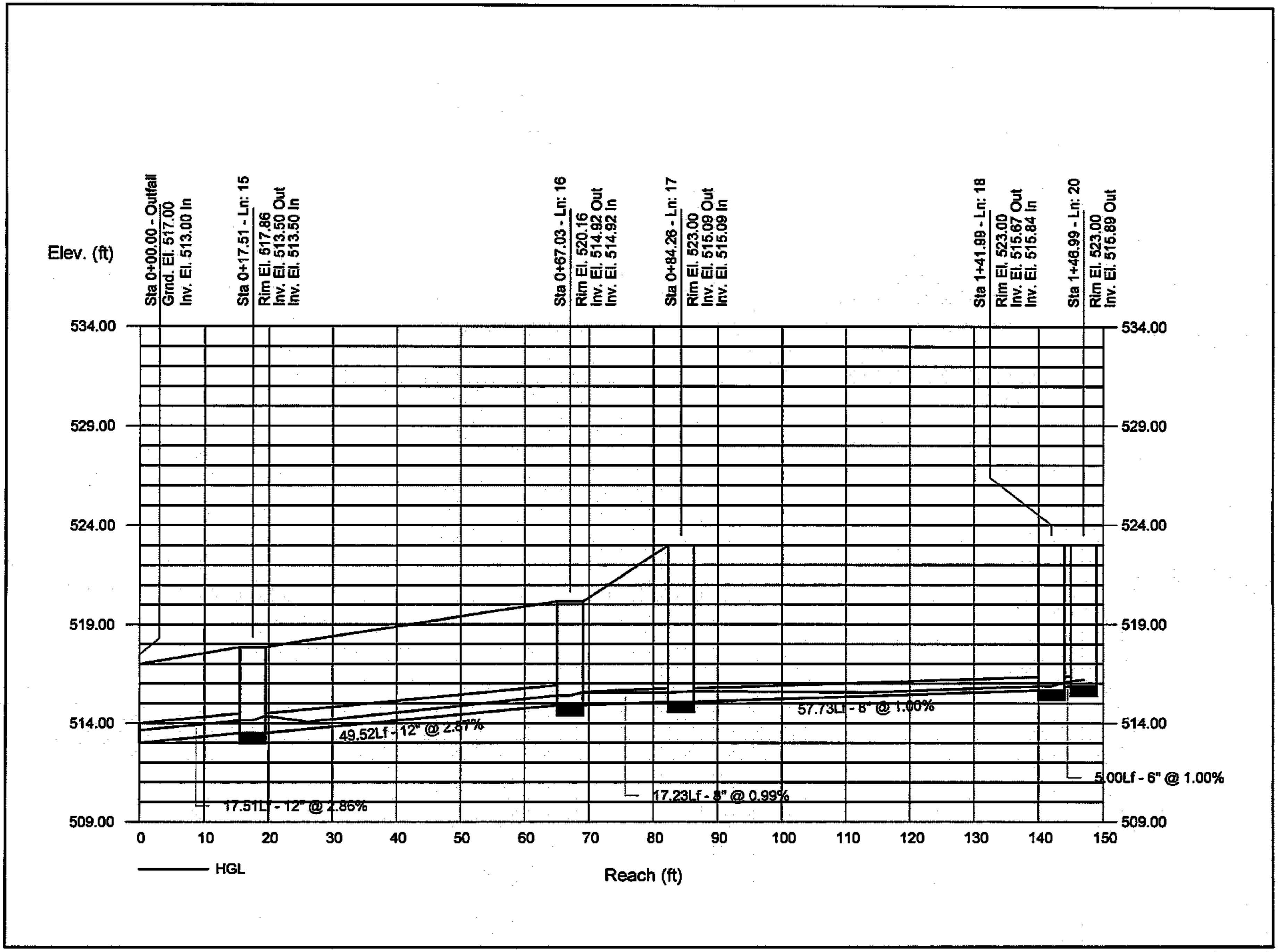
Storm Sewer Profile

Proj. file: Taylor Mill Storm Sewers 100.stm

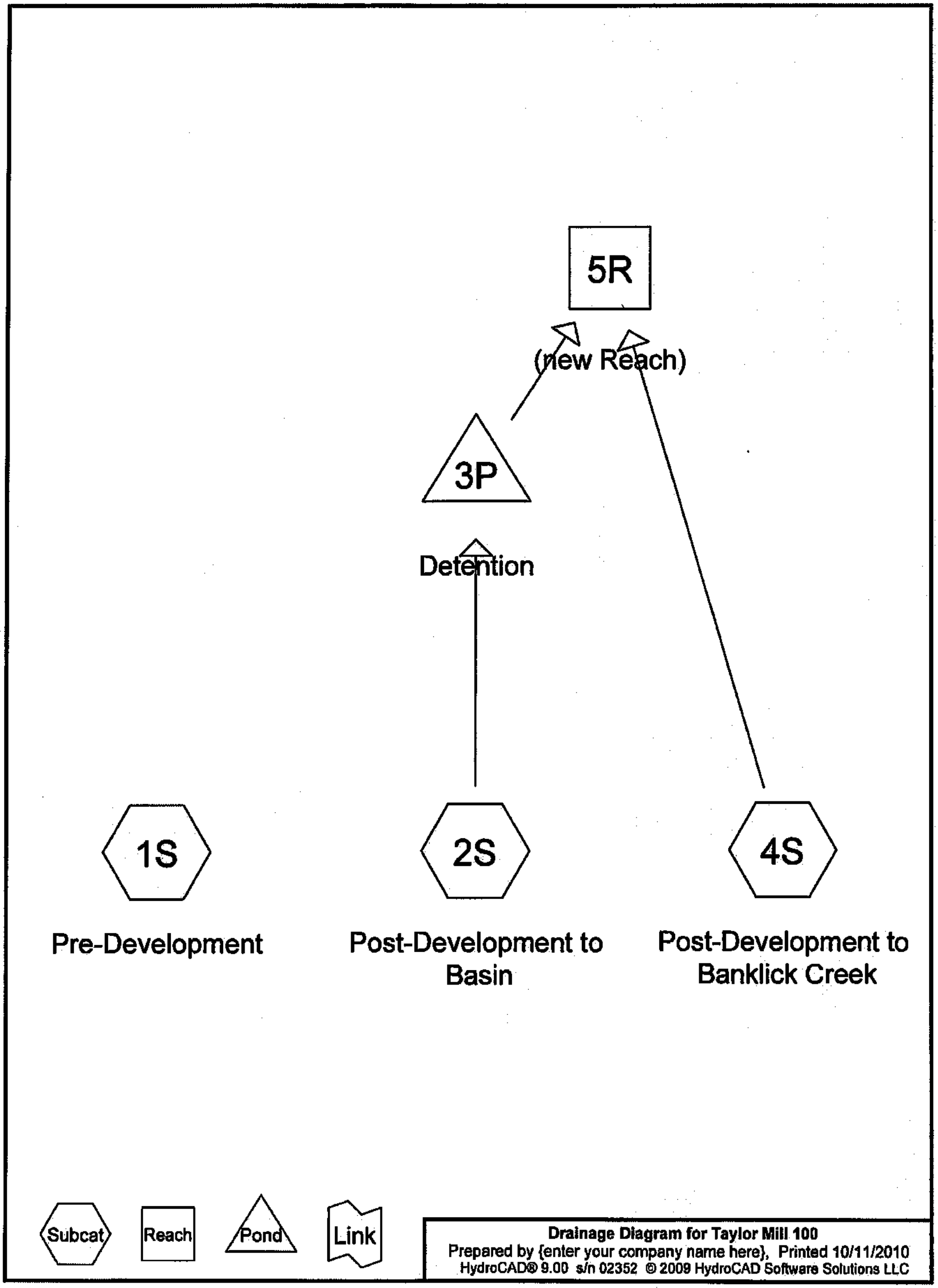


Storm Sewer Profile

Proj. file: Taylor Mill Storm Sewers 100.stm



APPENDIX B
HYDROCAD MODEL RESULTS


5R
(new Reach)
3P
Detention
1S
Pre-Development
2S
Post-Development to Basin
4S
Post-Development to Banklick Creek
Subcat
Reach
Pond
Link
Drainage Diagram for Taylor Mill 100
Prepared by {enter your company name here}, Printed 10/11/2010
HydroCAD® 9.00 s/n 02352 © 2009 HydroCAD Software Solutions LLC

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Development Runoff Area=6.090 ac 25.29% Impervious Runoff Depth>1.35"
Tc=6.0 min CN=81 Runoff=14.76 cfs 29,839 cf

Subcatchment 2S: Post-Development to Runoff Area=2.070 ac 36.23% Impervious Runoff Depth>1.70"
Tc=6.0 min CN=86 Runoff=6.26 cfs 12,795 cf

Subcatchment 4S: Post-Development to Runoff Area=4.020 ac 30.85% Impervious Runoff Depth>1.63"
Tc=6.0 min CN=85 Runoff=11.66 cfs 23,754 cf

Reach 5R: (new Reach) Inflow=14.07 cfs 35,559 cf
Outflow=14.07 cfs 35,559 cf

Pond 3P: Detention Peak Elev=499.53' Storage=3,731 cf Inflow=6.26 cfs 12,795 cf
Primary=2.86 cfs 11,805 cf Secondary=0.00 cfs 0 cf Outflow=2.86 cfs 11,805 cf

Total Runoff Area = 530,561 sf Runoff Volume = 66,388 cf Average Runoff Depth = 1.50"
71.02% Pervious = 376,794 sf 28.98% Impervious = 153,767 sf

Summary for Subcatchment 1S: Pre-Development

Runoff = 14.76 cfs @ 11.98 hrs, Volume= 29,839 cf, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.05"

	Area (ac)	CN	Description
*	1.540	98	Impervious Surfaces
*	4.300	79	Open Space Areas
*	0.250	1	Clarifiers
	6.090	81	Weighted Average
	4.550		74.71% Pervious Area
	1.540		25.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: Post-Development to Basin

Runoff = 6.26 cfs @ 11.97 hrs, Volume= 12,795 cf, Depth> 1.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.05"

	Area (ac)	CN	Description
*	0.750	98	Impervious Surfaces
*	1.030	79	Open Space Areas
*	0.290	80	Green Roof Areas
*	0.000	1	Clarifiers
	2.070	86	Weighted Average
	1.320		63.77% Pervious Area
	0.750		36.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: Post-Development to Banklick Creek

Runoff = 11.66 cfs @ 11.97 hrs, Volume= 23,754 cf, Depth> 1.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.05"

	Area (ac)	CN	Description
*	1.240	98	Impervious Surfaces
*	2.780	79	Open Space Areas
*	0.000	80	Green Roof Areas
*	0.000	1	Clarifiers
	4.020	85	Weighted Average
	2.780		69.15% Pervious Area
	1.240		30.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 5R: (new Reach)

Inflow Area = 265,280 sf, 32.68% Impervious, Inflow Depth > 1.61" for 2-Year event
Inflow = 14.07 cfs @ 11.98 hrs, Volume= 35,559 cf
Outflow = 14.07 cfs @ 11.98 hrs, Volume= 35,559 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Detention

Inflow Area = 90,169 sf, 36.23% Impervious, Inflow Depth > 1.70" for 2-Year event
Inflow = 6.26 cfs @ 11.97 hrs, Volume= 12,795 cf
Outflow = 2.86 cfs @ 12.07 hrs, Volume= 11,805 cf, Atten= 54%, Lag= 5.7 min
Primary = 2.86 cfs @ 12.07 hrs, Volume= 11,805 cf
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 499.53' @ 12.07 hrs Surf.Area= 2,362 sf Storage= 3,731 cf

Plug-Flow detention time= 64.0 min calculated for 11,805 cf (92% of inflow)
Center-of-Mass det. time= 22.8 min (843.4 - 820.6)

Volume	Invert	Avail.Storage	Storage Description
#1	497.00'	12,360 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
497.00	730	0	0	730
498.00	1,270	988	988	1,281
499.00	1,947	1,596	2,584	1,973
500.00	2,758	2,341	4,925	2,802
501.00	3,698	3,217	8,141	3,763
502.00	4,762	4,219	12,360	4,852

Device	Routing	Invert	Outlet Devices
#1	Primary	494.00'	**18.0" Round Culvert** L= 75.0' Ke= 0.500 Outlet Invert= 489.00' S= 0.0667 '/' Cc= 0.900 n= 0.013
#2	Device 1	497.00'	**0.06 cfs Exfiltration when above 497.00'**
#3	Device 1	498.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	499.50'	**20.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	501.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	501.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.85 cfs @ 12.07 hrs HW=499.53' (Free Discharge)
↑—**1=Culvert** (Passes 2.85 cfs of 18.61 cfs potential flow)
↑—**2=Exfiltration** (Exfiltration Controls 0.06 cfs)
—**3=Orifice/Grate** (Orifice Controls 2.72 cfs @ 5.44 fps)
—**4=Orifice/Grate** (Orifice Controls 0.06 cfs @ 0.58 fps)
—**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=497.00' (Free Discharge)
↑—**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Development Runoff Area=6.090 ac 25.29% Impervious Runoff Depth>2.42"
Tc=6.0 min CN=81 Runoff=26.21 cfs 53,583 cf

Subcatchment 2S: Post-Development to Runoff Area=2.070 ac 36.23% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=86 Runoff=10.32 cfs 21,570 cf

Subcatchment 4S: Post-Development to Runoff Area=4.020 ac 30.85% Impervious Runoff Depth>2.78"
Tc=6.0 min CN=85 Runoff=19.50 cfs 40,539 cf

Reach 5R: (new Reach) Inflow=26.08 cfs 61,062 cf
Outflow=26.08 cfs 61,062 cf

Pond 3P: Detention Peak Elev=500.08' Storage=5,144 cf Inflow=10.32 cfs 21,570 cf
Primary=7.78 cfs 20,522 cf Secondary=0.00 cfs 0 cf Outflow=7.78 cfs 20,522 cf

Total Runoff Area = 530,561 sf Runoff Volume = 115,693 cf Average Runoff Depth = 2.62"
71.02% Pervious = 376,794 sf 28.98% Impervious = 153,767 sf

Summary for Subcatchment 1S: Pre-Development

Runoff = 26.21 cfs @ 11.97 hrs, Volume= 53,583 cf, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.36"

	Area (ac)	CN	Description
*	1.540	98	Impervious Surfaces
*	4.300	79	Open Space Areas
*	0.250	1	Clarifiers
	6.090	81	Weighted Average
	4.550		74.71% Pervious Area
	1.540		25.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Summary for Subcatchment 2S: Post-Development to Basin

Runoff = 10.32 cfs @ 11.97 hrs, Volume= 21,570 cf, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.36"

	Area (ac)	CN	Description
*	0.750	98	Impervious Surfaces
*	1.030	79	Open Space Areas
*	0.290	80	Green Roof Areas
*	0.000	1	Clarifiers
	2.070	86	Weighted Average
	1.320		63.77% Pervious Area
	0.750		36.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Summary for Subcatchment 4S: Post-Development to Banklick Creek

Runoff = 19.50 cfs @ 11.97 hrs, Volume= 40,539 cf, Depth> 2.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.36"

	Area (ac)	CN	Description
*	1.240	98	Impervious Surfaces
*	2.780	79	Open Space Areas
*	0.000	80	Green Roof Areas
*	0.000	1	Clarifiers
	4.020	85	Weighted Average
	2.780		69.15% Pervious Area
	1.240		30.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 5R: (new Reach)

Inflow Area = 265,280 sf, 32.68% Impervious, Inflow Depth > 2.76" for 10-Year event
Inflow = 26.08 cfs @ 11.99 hrs, Volume= 61,062 cf
Outflow = 26.08 cfs @ 11.99 hrs, Volume= 61,062 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Detention

Inflow Area = 90,169 sf, 36.23% Impervious, Inflow Depth > 2.87" for 10-Year event
Inflow = 10.32 cfs @ 11.97 hrs, Volume= 21,570 cf
Outflow = 7.78 cfs @ 12.03 hrs, Volume= 20,522 cf, Atten= 25%, Lag= 3.4 min
Primary = 7.78 cfs @ 12.03 hrs, Volume= 20,522 cf
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 500.08' @ 12.03 hrs Surf.Area= 2,827 sf Storage= 5,144 cf

Plug-Flow detention time= 46.1 min calculated for 20,522 cf (95% of inflow)
Center-of-Mass det. time= 18.3 min (824.1 - 805.8)

Volume	Invert	Avail.Storage	Storage Description
#1	497.00'	12,360 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
497.00	730	0	0	730
498.00	1,270	988	988	1,281
499.00	1,947	1,596	2,584	1,973
500.00	2,758	2,341	4,925	2,802
501.00	3,698	3,217	8,141	3,763
502.00	4,762	4,219	12,360	4,852

Device	Routing	Invert	Outlet Devices
#1	Primary	494.00'	**18.0" Round Culvert** L= 75.0' Ke= 0.500 Outlet Invert= 489.00' S= 0.0667 '/' Cc= 0.900 n= 0.013
#2	Device 1	497.00'	**0.06 cfs Exfiltration when above 497.00'**
#3	Device 1	498.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	499.50'	**20.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	501.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	501.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=7.78 cfs @ 12.03 hrs HW=500.08' (Free Discharge)
└─**1=Culvert** (Passes 7.78 cfs of 19.64 cfs potential flow)
  ├─**2=Exfiltration** (Exfiltration Controls 0.06 cfs)
  ├─**3=Orifice/Grate** (Orifice Controls 3.25 cfs @ 6.50 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 4.46 cfs @ 2.68 fps)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=497.00' (Free Discharge)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Development Runoff Area=6.090 ac 25.29% Impervious Runoff Depth>3.11"
Tc=6.0 min CN=81 Runoff=33.36 cfs 68,836 cf

Subcatchment 2S: Post-Development to Runoff Area=2.070 ac 36.23% Impervious Runoff Depth>3.60"
Tc=6.0 min CN=86 Runoff=12.79 cfs 27,070 cf

Subcatchment 4S: Post-Development to Runoff Area=4.020 ac 30.85% Impervious Runoff Depth>3.50"
Tc=6.0 min CN=85 Runoff=24.29 cfs 51,108 cf

Reach 5R: (new Reach) Inflow=32.94 cfs 77,110 cf
Outflow=32.94 cfs 77,110 cf

Pond 3P: Detention Peak Elev=500.33' Storage=5,890 cf Inflow=12.79 cfs 27,070 cf
Primary=9.60 cfs 26,001 cf Secondary=0.00 cfs 0 cf Outflow=9.60 cfs 26,001 cf

Total Runoff Area = 530,561 sf Runoff Volume = 147,014 cf Average Runoff Depth = 3.33"
71.02% Pervious = 376,794 sf 28.98% Impervious = 153,767 sf

Summary for Subcatchment 1S: Pre-Development

Runoff = 33.36 cfs @ 11.97 hrs, Volume= 68,836 cf, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.15"

	Area (ac)	CN	Description
*	1.540	98	Impervious Surfaces
*	4.300	79	Open Space Areas
*	0.250	1	Clarifiers
	6.090	81	Weighted Average
	4.550		74.71% Pervious Area
	1.540		25.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: Post-Development to Basin

Runoff = 12.79 cfs @ 11.97 hrs, Volume= 27,070 cf, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.15"

	Area (ac)	CN	Description
*	0.750	98	Impervious Surfaces
*	1.030	79	Open Space Areas
*	0.290	80	Green Roof Areas
*	0.000	1	Clarifiers
	2.070	86	Weighted Average
	1.320		63.77% Pervious Area
	0.750		36.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: Post-Development to Banklick Creek

Runoff = 24.29 cfs @ 11.97 hrs, Volume= 51,108 cf, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.15"

	Area (ac)	CN	Description
*	1.240	98	Impervious Surfaces
*	2.780	79	Open Space Areas
*	0.000	80	Green Roof Areas
*	0.000	1	Clarifiers
	4.020	85	Weighted Average
	2.780		69.15% Pervious Area
	1.240		30.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 5R: (new Reach)

Inflow Area = 265,280 sf, 32.68% Impervious, Inflow Depth > 3.49" for 25-Year event
Inflow = 32.94 cfs @ 11.98 hrs, Volume= 77,110 cf
Outflow = 32.94 cfs @ 11.98 hrs, Volume= 77,110 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Detention

Inflow Area = 90,169 sf, 36.23% Impervious, Inflow Depth > 3.60" for 25-Year event
Inflow = 12.79 cfs @ 11.97 hrs, Volume= 27,070 cf
Outflow = 9.60 cfs @ 12.03 hrs, Volume= 26,001 cf, Atten= 25%, Lag= 3.4 min
Primary = 9.60 cfs @ 12.03 hrs, Volume= 26,001 cf
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 500.33' @ 12.03 hrs Surf.Area= 3,055 sf Storage= 5,890 cf

Plug-Flow detention time= 40.5 min calculated for 26,001 cf (96% of inflow)
Center-of-Mass det. time= 17.3 min (816.7 - 799.4)

Volume	Invert	Avail.Storage	Storage Description
#1	497.00'	12,360 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
497.00	730	0	0	730
498.00	1,270	988	988	1,281
499.00	1,947	1,596	2,584	1,973
500.00	2,758	2,341	4,925	2,802
501.00	3,698	3,217	8,141	3,763
502.00	4,762	4,219	12,360	4,852

Device	Routing	Invert	Outlet Devices
#1	Primary	494.00'	**18.0" Round Culvert** L= 75.0' Ke= 0.500 Outlet Invert= 489.00' S= 0.0667 '/' Cc= 0.900 n= 0.013
#2	Device 1	497.00'	**0.06 cfs Exfiltration when above 497.00'**
#3	Device 1	498.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	499.50'	**20.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	501.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	501.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=9.60 cfs @ 12.03 hrs HW=500.33' (Free Discharge)
└─**1=Culvert** (Passes 9.60 cfs of 20.10 cfs potential flow)
  ├─**2=Exfiltration** (Exfiltration Controls 0.06 cfs)
  ├─**3=Orifice/Grate** (Orifice Controls 3.47 cfs @ 6.94 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 6.07 cfs @ 3.64 fps)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=497.00' (Free Discharge)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Development Runoff Area=6.090 ac 25.29% Impervious Runoff Depth>3.68"
Tc=6.0 min CN=81 Runoff=39.12 cfs 81,325 cf

Subcatchment 2S: Post-Development to Runoff Area=2.070 ac 36.23% Impervious Runoff Depth>4.20"
Tc=6.0 min CN=86 Runoff=14.76 cfs 31,525 cf

Subcatchment 4S: Post-Development to Runoff Area=4.020 ac 30.85% Impervious Runoff Depth>4.09"
Tc=6.0 min CN=85 Runoff=28.12 cfs 59,685 cf

Reach 5R: (new Reach) Inflow=37.94 cfs 90,126 cf
Outflow=37.94 cfs 90,126 cf

Pond 3P: Detention Peak Elev=500.54' Storage=6,551 cf Inflow=14.76 cfs 31,525 cf
Primary=10.81 cfs 30,441 cf Secondary=0.00 cfs 0 cf Outflow=10.81 cfs 30,441 cf

Total Runoff Area = 530,561 sf Runoff Volume = 172,535 cf Average Runoff Depth = 3.90"
71.02% Pervious = 376,794 sf 28.98% Impervious = 153,767 sf

Summary for Subcatchment 1S: Pre-Development

Runoff = 39.12 cfs @ 11.97 hrs, Volume= 81,325 cf, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.78"

	Area (ac)	CN	Description
*	1.540	98	Impervious Surfaces
*	4.300	79	Open Space Areas
*	0.250	1	Clarifiers
	6.090	81	Weighted Average
	4.550		74.71% Pervious Area
	1.540		25.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: Post-Development to Basin

Runoff = 14.76 cfs @ 11.97 hrs, Volume= 31,525 cf, Depth> 4.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.78"

	Area (ac)	CN	Description
*	0.750	98	Impervious Surfaces
*	1.030	79	Open Space Areas
*	0.290	80	Green Roof Areas
*	0.000	1	Clarifiers
	2.070	86	Weighted Average
	1.320		63.77% Pervious Area
	0.750		36.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: Post-Development to Banklick Creek

Runoff = 28.12 cfs @ 11.97 hrs, Volume= 59,685 cf, Depth> 4.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.78"

	Area (ac)	CN	Description
*	1.240	98	Impervious Surfaces
*	2.780	79	Open Space Areas
*	0.000	80	Green Roof Areas
*	0.000	1	Clarifiers
	4.020	85	Weighted Average
	2.780		69.15% Pervious Area
	1.240		30.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 5R: (new Reach)

Inflow Area = 265,280 sf, 32.68% Impervious, Inflow Depth > 4.08" for 50-Year event
Inflow = 37.94 cfs @ 11.98 hrs, Volume= 90,126 cf
Outflow = 37.94 cfs @ 11.98 hrs, Volume= 90,126 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Detention

Inflow Area = 90,169 sf, 36.23% Impervious, Inflow Depth > 4.20" for 50-Year event
Inflow = 14.76 cfs @ 11.97 hrs, Volume= 31,525 cf
Outflow = 10.81 cfs @ 12.03 hrs, Volume= 30,441 cf, Atten= 27%, Lag= 3.5 min
Primary = 10.81 cfs @ 12.03 hrs, Volume= 30,441 cf
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 500.54' @ 12.03 hrs Surf.Area= 3,250 sf Storage= 6,551 cf

Plug-Flow detention time= 37.3 min calculated for 30,428 cf (97% of inflow)
Center-of-Mass det. time= 16.8 min (811.9 - 795.1)

Volume	Invert	Avail.Storage	Storage Description
#1	497.00'	12,360 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
497.00	730	0	0	730
498.00	1,270	988	988	1,281
499.00	1,947	1,596	2,584	1,973
500.00	2,758	2,341	4,925	2,802
501.00	3,698	3,217	8,141	3,763
502.00	4,762	4,219	12,360	4,852

Device	Routing	Invert	Outlet Devices
#1	Primary	494.00'	**18.0" Round Culvert** L= 75.0' Ke= 0.500 Outlet Invert= 489.00' S= 0.0667 '/' Cc= 0.900 n= 0.013
#2	Device 1	497.00'	**0.06 cfs Exfiltration when above 497.00'**
#3	Device 1	498.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	499.50'	**20.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	501.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	501.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=10.81 cfs @ 12.03 hrs HW=500.54' (Free Discharge)
└─**1=Culvert** (Passes 10.81 cfs of 20.48 cfs potential flow)
 ├─**2=Exfiltration** (Exfiltration Controls 0.06 cfs)
 ├─**3=Orifice/Grate** (Orifice Controls 3.64 cfs @ 7.28 fps)
 ├─**4=Orifice/Grate** (Orifice Controls 7.11 cfs @ 4.27 fps)
 └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=497.00' (Free Discharge)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Development Runoff Area=6.090 ac 25.29% Impervious Runoff Depth>4.28"
Tc=6.0 min CN=81 Runoff=45.18 cfs 94,640 cf

Subcatchment 2S: Post-Development to Runoff Area=2.070 ac 36.23% Impervious Runoff Depth>4.82"
Tc=6.0 min CN=86 Runoff=16.82 cfs 36,239 cf

Subcatchment 4S: Post-Development to Runoff Area=4.020 ac 30.85% Impervious Runoff Depth>4.71"
Tc=6.0 min CN=85 Runoff=32.12 cfs 68,776 cf

Reach 5R: (new Reach) Inflow=42.99 cfs 103,915 cf
Outflow=42.99 cfs 103,915 cf

Pond 3P: Detention Peak Elev=500.77' Storage=7,301 cf Inflow=16.82 cfs 36,239 cf
Primary=11.94 cfs 35,140 cf Secondary=0.00 cfs 0 cf Outflow=11.94 cfs 35,140 cf

Total Runoff Area = 530,561 sf Runoff Volume = 199,655 cf Average Runoff Depth = 4.52"
71.02% Pervious = 376,794 sf 28.98% Impervious = 153,767 sf

Summary for Subcatchment 1S: Pre-Development

Runoff = 45.18 cfs @ 11.97 hrs, Volume= 94,640 cf, Depth> 4.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.44"

	Area (ac)	CN	Description
*	1.540	98	Impervious Surfaces
*	4.300	79	Open Space Areas
*	0.250	1	Clarifiers
	6.090	81	Weighted Average
	4.550		74.71% Pervious Area
	1.540		25.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: Post-Development to Basin

Runoff = 16.82 cfs @ 11.97 hrs, Volume= 36,239 cf, Depth> 4.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.44"

	Area (ac)	CN	Description
*	0.750	98	Impervious Surfaces
*	1.030	79	Open Space Areas
*	0.290	80	Green Roof Areas
*	0.000	1	Clarifiers
	2.070	86	Weighted Average
	1.320		63.77% Pervious Area
	0.750		36.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: Post-Development to Banklick Creek

Runoff = 32.12 cfs @ 11.97 hrs, Volume= 68,776 cf, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.44"

	Area (ac)	CN	Description
*	1.240	98	Impervious Surfaces
*	2.780	79	Open Space Areas
*	0.000	80	Green Roof Areas
*	0.000	1	Clarifiers
	4.020	85	Weighted Average
	2.780		69.15% Pervious Area
	1.240		30.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 5R: (new Reach)

Inflow Area = 265,280 sf, 32.68% Impervious, Inflow Depth > 4.70" for 100-Year event
Inflow = 42.99 cfs @ 11.98 hrs, Volume= 103,915 cf
Outflow = 42.99 cfs @ 11.98 hrs, Volume= 103,915 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Detention

Inflow Area = 90,169 sf, 36.23% Impervious, Inflow Depth > 4.82" for 100-Year event
Inflow = 16.82 cfs @ 11.97 hrs, Volume= 36,239 cf
Outflow = 11.94 cfs @ 12.03 hrs, Volume= 35,140 cf, Atten= 29%, Lag= 3.7 min
Primary = 11.94 cfs @ 12.03 hrs, Volume= 35,140 cf
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 500.77' @ 12.03 hrs Surf.Area= 3,465 sf Storage= 7,301 cf

Plug-Flow detention time= 34.8 min calculated for 35,140 cf (97% of inflow)
Center-of-Mass det. time= 16.4 min (807.6 - 791.2)

Volume	Invert	Avail.Storage	Storage Description
#1	497.00'	12,360 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
497.00	730	0	0	730
498.00	1,270	988	988	1,281
499.00	1,947	1,596	2,584	1,973
500.00	2,758	2,341	4,925	2,802
501.00	3,698	3,217	8,141	3,763
502.00	4,762	4,219	12,360	4,852

Device	Routing	Invert	Outlet Devices
#1	Primary	494.00'	**18.0" Round Culvert** L= 75.0' Ke= 0.500 Outlet Invert= 489.00' S= 0.0667 '/' Cc= 0.900 n= 0.013
#2	Device 1	497.00'	**0.06 cfs Exfiltration when above 497.00'**
#3	Device 1	498.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	499.50'	**20.0" W x 6.0" H Vert. Orifice/Grate X 2.00** C= 0.600
#5	Device 1	501.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	501.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=11.94 cfs @ 12.03 hrs HW=500.76' (Free Discharge)
└─**1=Culvert** (Passes 11.94 cfs of 20.87 cfs potential flow)
  ├─**2=Exfiltration** (Exfiltration Controls 0.06 cfs)
  ├─**3=Orifice/Grate** (Orifice Controls 3.82 cfs @ 7.63 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 8.06 cfs @ 4.84 fps)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=497.00' (Free Discharge)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

184-731

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December 10, 2010

Mr. Barry Elmore, P.E.
Department for Environmental Protection
Division of Water
200 Fair Oaks Lane
Frankfort, KY 40601

Re: Northern Kentucky Water District
Taylor Mill Water Treatment Plant
Site Drainage Improvements
Kenton County, Kentucky

Dear Mr. Elmore:

We are assisting the Northern Kentucky Water District in preparation of construction drawing and permit applications. The proposed improvement project is located in the upland area of its property. The project has two proposed storm sewer outfalls that are proposed to discharged at an existing ephemeral ditch. These ditches are formed by a rip-rapped channel at an outfall headwall that currently serves the developed portion of the property/treatment plant facilities. Since the proposed headwalls will be constructed in the floodplain of Banklick Creek, which is influenced by the backwater of the Ohio River, we are requesting a permit to construct in the floodplain.

We have attached the following support documentation:

1. Permit Application
2. 11" x 17" copy of the Site Grading Plan and Yard Piping–Storm Sewers drawings
3. Site Photographs
4. Site Location Map
5. DIFM Exhibit

Please process the Application for Permit to Construct Across or Along a Stream. Applications and support documents have also been filed with the United States Army Corps of Engineers (USACE) and the Kentucky Division of Water–Water Quality section.

If you have any questions, please advise at your earliest convenience.

Sincerely,

STRAND ASSOCIATES, INC.®

Darrell A. Edwards

Darrell A. Edwards, P.E.

Enclosure

c: Amy Kramer, Northern Kentucky Water District
Alan Grant, Kentucky Division of Water
Mike Hasting, USACE

DAE:clw\S:\CIN\1500--1599\1547\002\Wrd\Permit App & Submittal\Elmore Floodplain Permit Submittal.docx

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October 29, 2010

Mr. Alan Grant, P.E.
Department for Environmental Protection
Division of Water
200 Fair Oaks Lane
Frankfort, KY 40601

Re: Northern Kentucky Water District
Taylor Mill Water Treatment Plant
Site Drainage Improvements
Kenton County, Kentucky

Dear Mr. Grant:

We are assisting the Northern Kentucky Water District in preparation of construction drawing and permit applications. The proposed improvement project is located in the upland area of its property. The project has two proposed storm sewer outfalls that are proposed to discharged at an existing ephemeral ditch. These ditches are formed by a rip-rapped channel at a outfall headwall that currently serves the developed portion of the property/treatment plant facilities. Since the proposed headwalls will be constructed to discharge on each side the existing headwall into the rip-rapped channel, we assumed the construction activity would fall under a Nationwide Permit No. 7.

We have attached the following support documentation:

1. Permit Application
2. Preliminary Jurisdictional Determination form
3. 11" X 17" copy of the Site Grading Plan and Yard Piping–Storm Sewers drawings
4. Site Photographs
5. Site Location Map
6. DIFM Exhibit

Please process the request for the Water Quality Certification. Applications and support documents have also been filed with the United States Army Corps of Engineers (USACE) and the Kentucky Division of Water–Floodplain section.

If you have any questions, please advise at your earliest convenience.

Sincerely,

STRAND ASSOCIATES, INC.®

Darrell A. Edwards, P.E.

Enclosure

c: Amy Kramer, Northern Kentucky Water District
Barry Elmore, Kentucky Division of Water
Mike Hasting, USACE

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COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES & ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRNOMENTAL PROTECTION
DIVISION OF WATER

APPLICATION FOR PERMIT TO CONSTRUCT ACROSS OR ALONG A STREAM AND / OR WATER QUALITY CERTIFICATION

Chapter 151 of the Kentucky Revised Statutes requires approval from the Division of Water prior to any construction or other activity in or along a stream that could in any way obstruct flood flows or adversely impact water quality. *If the project involves work in a stream, such as bank stabilization, dredging or relocation, you will also need to obtain a 401 Water Quality Certification (WQC) from the Division of Water.* This completed form will be forwarded to the Water Quality Branch for WQC processing. The project may not start until all necessary approvals are received from the KDOW. For questions concerning the WQC process, contact the WQC section at 502/564-3410.

If the project will disturb more than 1 acre of soil, you will also need to complete the attached Notice of Intent for Storm Water Discharges, and return both forms to the Floodplain management Section of the KDOW. This general permit will require you to create an implement an erosion control plan for the project.

1. OWNER: Northern Kentucky Water District , Amy Kramer
Give name of person(s), company, governmental unit, or other owner of proposed project.
MAILING ADDRESS: 2835 Crescent Springs Road, P.O. Box 18640, Erlanger, Kentucky 41018
TELEPHONE #: (859)-426-2734 EMAIL: akramer@nkywater.org

2. AGENT: Christopher Dent, P. E.
Give name of person(s) submitting application, if other than owner.
ADDRESS: 1525 Bull Lea Road, Suite 100; Lexington, Kentucky 40511
TELEPHONE #: (859)-225-8500 EMAIL: chris.dent@strand.com

3. ENGINEER: Christopher Dent, P. E. P.E. NUMBER: 26087
Contact Division of Water if waiver can be granted.
TELEPHONE #: (859)-225-8500 EMAIL: chris.dent@strand.com

4. DESCRIPTION OF CONSTRUCTION: Construction of two outfall headwalls for the release of stormwater rnnoff
Describe the type and purpose of construction and describe stream impact
and overflow discharge from the water treatment plant. Both headwalls will be constructed to discharge into an existing rip-rapped channel located at the end of an existing storm sewer headwall. The proposed headwalls will he constructed with one headwall on each side of the existing headwall. The channel will have additional rip-rap added to maintain the hank stabilization with the confluence of three different discharge systems.

5. COUNTY: Kenton NEAREST COMMUNITY: Taylor Mill, Kentucky

6. USGS QUAD NAME Covington, Kentucky LATITUDE/LONGITUDE: 39°02'05"N / 84°30'24"W

7. STREAM NAME: Banklick Creek WATERSHED SIZE (in acres): Four

8. LINEAR FEET OF STREAM IMPACTED: 15 feet

9. DIRECTIONS TO SITE: Take the Taylor Mill Road exit off of I-275 to go north one mile to Grand Avenue. Turn right onto Grand Avenue and proceed east past Kollman Ave. with the Treatment Plant facility located on the north side of the road. Address for existing WTP is 602 Grand Avenue. The adjoining lot proposed for expansion is 632 Grand Avenue.

10. **IS ANY PORTION OF THE REQUESTED PROJECT NOW COMPLETE?** Yes X No If yes, identify the completed portion on the drawings you submit and indicate the date activity was completed. DATE: ________

11. **ESTIMATED BEGIN CONSTRUCTION DATE:** March 2011

12. **ESTIMATED END CONSTRUCTION DATE:** June 2012

13. **HAS A PERMIT BEEN RECEIVED FROM THE US ARMY, CORPS of ENGINEERS?** Yes X No If yes, attach a copy of that permit.

14. **THE APPLICANT *MUST* ADDRESS PUBLIC NOTICE:**

(a) PUBLIC NOTICE HAS BEEN GIVEN FOR THIS PROPOSAL BY THE FOLLOWING MEANS:

____ **Public notice in newspaper having greatest circulation in area** (provide newspaper clipping or affidavit)

____ **Adjacent property owner(s) affidavits** (Contact Division of Water for requirements.)

(b) X I REQUEST WAIVER OF PUBLIC NOTICE BECAUSE:

All work will be performed on Northern Kentucky Water District property and an existing outfall site

Contact Division of Water for requirements.

15. **I HAVE CONTACTED THE FOLLOWING CITY OR COUNTY OFFICIALS CONCERNING THIS PROJECT:**

Sean Blake with Sanitation District No. 1 of Northern Kentucky

Give name and title of person(s) contacted and provide copy of any approval city or county may have issued.

16. **LIST OF ATTACHMENTS:** Site location map on US GS Quad sheet, 11" X 17" copy of the Site Grading Plan

List plans, profiles, or other drawings and data submitted. Attach a copy of a 7.5 minute USGS topographic map clearly showing the project location.

and Yard Piping - Storm Sewer drawings, Site photographs.

17. **I,** AKK (owner) **CERTIFY THAT THE OWNER OWNS OR HAS EASEMENT RIGHTS ON ALL PROPERTY ON WHICH THIS PROJECT WILL BE LOCATED OR ON WHICH RELATED CONSTRUCTION WILL OCCUR** (for dams, this includes the area that would be impounded during the design flood).

18. **REMARKS:** Proposed construction activities are located on Northern Kentucky Water District property and do not require additional easements. The proposed work at the outfall structures is located in the backwater floodplain of the Ohio River. Likewise the minor embankment fill of the stormwater management basin will not affect flood conveyance as it is located in the floodway fringe area.

I hereby request approval for construction across or along a stream as described in this application and any accompanying documents. To the best of my knowledge, all the information provided is true and correct.

SIGNATURE: Amy Kramer

Owner or Agent sign here. (If signed by Agent, a Power of Attorney should be attached.)

DATE: 11/12/10

SIGNATURE OF LOCAL FLOODPLAIN COORDINATOR:

Permit application will be returned to applicant if not properly endorsed by the local floodplain coordinator.

DATE: 12/3/10

SUBMIT APPLICATION AND ATTACHMENTS TO:

Floodplain Management Section
Division of Water
14 Reilly Road
Frankfort, KY 40601

Revised 01-04

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Cincinnati, OH
Phoenix, AZ

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November 17, 2010

Mike Hastings, P.E.
U.S. Army Corps of Engineers
600 Martin Luther King Jr. Place
P.O. Box 59
Louisville, KY 40201-0059

Re: Northern Kentucky Water District
Taylor Mill Water Treatment Plant
Site Drainage Improvements
Kenton County, Kentucky

Dear Mr. Hastings:

We are assisting the Northern Kentucky Water District (NKWD) in preparation of construction drawing and permit applications. The proposed improvement project is located in the upland area of the NKWD property. The project has two proposed storm sewer outfalls proposed to discharge at an existing ephemeral ditch. These ditches are formed by a rip-rapped channel at a outfall headwall that currently serves the developed portion of the property/treatment plant facilities. Since the proposed headwalls will be constructed to discharge on each side of the existing headwall into the rip-rapped channel, we assumed the construction activity would fall under a Nationwide Permit No. 7.

We have attached the following support documentation:

- Permit Application
- Preliminary Jurisdictional Determination form
- 11" X 17" copy of the Site Grading Plan and Yard Piping–Storm Sewers drawings
- Site Photographs
- Site Location Map

Please process the request for the permit or issue a statement that the proposed activities are nonjurisdictional relative to the United States Army Corps of Engineers.

If you have any questions, please advise at your earliest convenience.

Sincerely,

STRAND ASSOCIATES, INC.®

Darrell A. Edwards

Darrell A. Edwards, P.E.

Enclosure

c: Amy Kramer, Northern Kentucky Water District
Barry Elmore, Kentucky Division of Water
Alan Grant, Kentucky Division of Water

DAE:clw\S:\CIN\1500--1599\1547\002\Wrd\Permit App & Submittal\Hasting 404 Permit Confirmation.docx

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Columbus, IN
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Indianapolis, IN
Milwaukee, WI
Cincinnati, OH
Phoenix, AZ

www.strand.com

November 17, 2010

Mr. Mark Dennen
State Historic Preservation Office
300 Washington Street
Frankfort, KY 40601

Re: Proposed Taylor Mill Water Treatment Plant Expansion
Kenton County, Taylor Mill, Kentucky

Dear Mr. Dennen:

On the behalf of our client, Northern Kentucky Water District (NKWD), we request a confirmation of no effect for the proposed construction activities associated with the above-referenced project.

In the process of compliance with the conditions of the 404 Clean Water Act, we have filed a permit application with the United States Army Corps of Engineers (USACE). The application, in way of a preconstruction notification of activities, is for a Nationwide Permit No. 7. The scope of construction will involve upgrading a portion of the existing water treatment plant site and the expansion of facilities to the adjacent lot owned by NKWD.

We have provide the following project support information for your reference:

1. Copy of the USACE application
2. 11" x 17" copy of the Site Grading Plan and Yard Piping-Storm Sewer drawings
3. Site Location Map
4. Photographs

Let me know if you need any additional information in order to issue the confirmation letter.

Sincerely,

STRAND ASSOCIATES, INC.®

Darrell A. Edwards

Darrell A. Edwards, P.E.

Enclosure(s)

c: Amy Kramer, Northern Kentucky Water District
Mike Hastings, United States Army Corps of Engineers

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Columbus, IN
Columbus, OH
Indianapolis, IN
Milwaukee, WI
Cincinnati, OH
Phoenix, AZ

www.strand.com

November 17, 2010

Mr. Martin Scribner
Flood Control Officer
2332 Royal Drive
Ft. Mitchell, KY 41017

Re: Proposed Taylor Mill Water Treatment Plant Expansion
Kenton County, Taylor Mill, Kentucky

Dear Mr. Scribner:

On the behalf of our client, Northern Kentucky Water District, we request your signature and return of the Kentucky Division of Water (KDOW) permit application enclosed. A KDOW permit is required for the proposed construction activities associated with the above-referenced project.

I have included with the application other reference information that should provide you an understanding of the scope work represented on the permit application. This information includes:

1. Copy of the KDOW application
2. 11" x 17" copy of the Site Grading Plan and Yard Piping-Storm Sewer drawings
3. Site Location Map
4. Photographs

Let me know if you need any additional information in order to sign your acknowledgement on the application. A return envelope is enclosed for you convenience.

Sincerely,

STRAND ASSOCIATES, INC.®

Darrell A. Edwards

Darrell A. Edwards, P.E.

Enclosure(s)

c: Amy Kramer, Northern Kentucky Water District

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APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT (33 CFR 325)	OMB APPROVAL NO. 0710-0003 Expires December 31, 2004

The Public burden for this collection of information is estimated to average 10 hours per response, although the majority of applications should require 5 hours or less. This includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research and Sanctuaries Act, 33 USC 1413, Section 103. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE *(an agent is not required)*
Amy Kramer, Northern Kentucky Water District **akramer@nkywater.org**	**Christopher Dent, P.E.** **chris.dent@strand.com**
6. APPLICANT'S ADDRESS	9. AGENT'S ADDRESS
Northern Kentucky Water District; 2835 Crescent Springs Road, P.O. Box 18640 **Erlanger, Kentucky 41018**	**Strand Associates, Inc.; 1525 Bull Lea Road, Suite 100** **Lexington, Kentucky 40511**
7. APPLICANT'S PHONE NOS. W/AREA CODE	10. AGENT'S PHONE NOS. W/AREA CODE
a. Residence b. Business **(859)-426-2734**	a. Residence b. Business **(859)-225-8500**

11. STATEMENT OF AUTHORIZATION

I hereby authorize **Chris Dent** to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

Amy Kramer — 11/12/10

APPLICANT'S SIGNATURE — DATE

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE *(see instructions)* **Advance Treatment Improvements for the Northern Kentucky Water District at the Taylor Mill Water Treatment Plant site.**

13. NAME OF WATERBODY, IF KNOWN *(if applicable)*	14. PROJECT STREET ADDRESS *(if applicable)*
Banklick Creek	**602 & 632 Grand Avenue, Taylor Mill, Kentucky**
15. LOCATION OF PROJECT **Kenton** (COUNTY) **Kentucky** (STATE)	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

17. DIRECTIONS TO THE SITE **Take the Taylor Mill Road exit off of I-275 to go north one mile to Grand Avenue. Turn right onto Grand Avenue and proceed east past Kollman Ave. with the Treatment Plant facility located on the north side of the road.**

18. Nature of Activity *(Description of project, include all features)*

Construction of two outfall headwalls for the release of stormwater runoff and overflow discharge from the water treatment plant. Both headwalls will be constructed to discharge into an existing rip-rapped channel located at the end of an existing storm sewer headwall. Tbe proposed headwalls will be constructed with one headwall on each side of the existing headwall. The channel will have additional rip-rap added to maintain the bank stabilization with the confluence of three different discharge systems.

19. Project Purpose *(Describe the reason or purpose of the project, see instructions)* **The water treatment plant (WTP) is expanding with the construction of additional facilities and renovation of portions of the existing WTP. The new facilities include the drainage infrastructure to collect, manage and discharge site stormwater runoff to a controlled discharge point. A new outfall from the existing WTP for processing overflow from the plant is included as the second headwall.**

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge **To construct a stabilized discharge system that would allow controlled release of site runoff to leave the site and drain to Banklick Creek. Two headwalls will be cut into the embankment with the existing rip-rap adjusted to accommodate the alignments of the headwalls. Additional rip-rap will be added match in the installation of the additional headwalls and replenish the smaller rip-rap that has migrated along the ephemeral channel.**

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards **Installation of two precast concrete headwalls to accommodate an 18" & 24" diameter storm sewer and 7 cu. yds. of rip-rap for bank stabilization.**

22. Surface Area in Acres of Wetlands or Other Waters Filled *(see instructions)* **No wetlands affected. Proposed construction expands existing rip-rap channel.**

23. Is Any Portion of the Work Already Complete? Yes ________ No __X__ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list). **Construction activities are located on Northern Kentucky Water District property.**

25. List of Other Certifications or Approvals/Denials Received from other Federal, State, or Local Agencies for Work Described in This Application

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
Kentucky Division of Water	**Water Quality Certification**	**Pending**	**November 2010**		
Kentucky Division of Water	**Floodplain Construction**	**Pending**	**November 2010**		

*Would include but is not restricted to zoning, building and flood plain permits

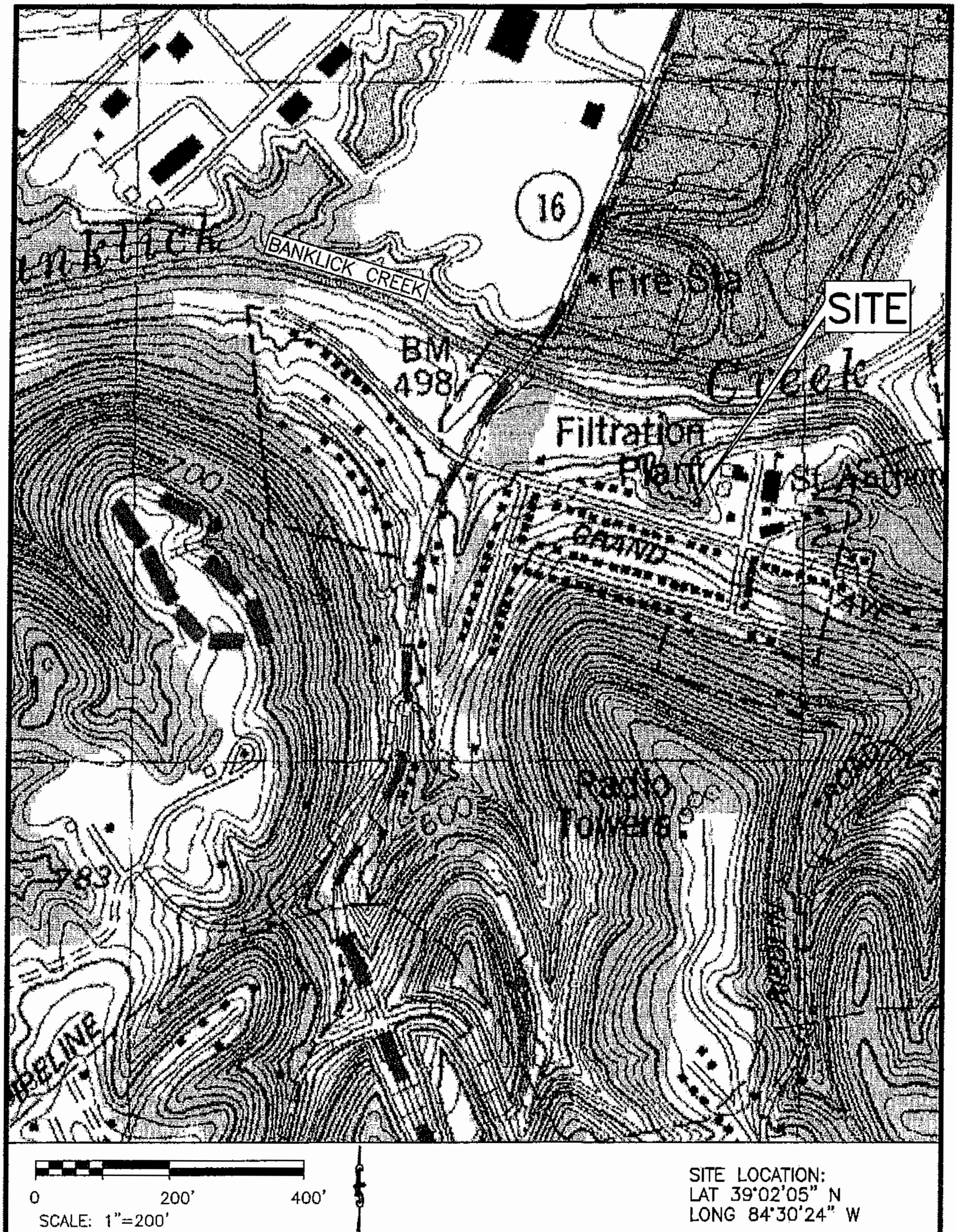
26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

Amy Kramer — 11/12/10 — Christopher S. Dust — 11/17/2010

SIGNATURE OF APPLICANT — DATE — SIGNATURE OF AGENT — DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.



TAYLOR MILL WATER TREATMENT PLANT SITE
KENTON, KY USGS QUAD
OCTOBER 2010

STRAND ASSOCIATES, INC. ENGINEERS®

ATTACHMENT

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): October 22, 2010

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:

Northern Kentucky Water District
Atten: Amy Kramer
2835 Crescent Springs Road
Erlanger, Kentucky 41018

Represented by:
Darrell A. Edwards
Strand Associates, Inc.
1525 Bull Lea Road
Lexington, Kentucky 40511

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Louisville District (CELRL-OP-FS), Taylor Mill Water Treatment Plant Advance Improvements, Kenton County, Kentucky, LRL-2010-

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: The Northern Kentucky Water District Advance Treatment Improvements project for the Taylor Mill Water Treatment Plant (WTP) is located at 602 & 632 Grand Avenue, Taylor Mill, Kentucky. The new facilities and expansion activities are proposed to be constructed in the upland area along Grand Avenue and located on the south side of Banklick Creek. An existing ephemeral ditch that is rap-rapped at the end of an existing headwall will be the location of construction nearest to Banklick Creek. The ephemeral ditch, on the property of Northern Kentucky Water District, conveys the stormwater runoff from the WTP to Banklick Creek. It is at the existing headwall and rip-rapped channel that two addition headwalls are to be construct for new outfall systems for site stormwater runoff and raw water overflow from the WTP. The proposed scope of work falls under the Nationwide No. 7 permit conditions.

(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: Kentucky County/parish/borough: Kenton City: Taylor Mill
Center coordinates of site (lat/long in degree decimal format): **Lat. 39.0347° N, Long. 84.5133° W**.
Universal Transverse Mercator: NAD 27 (715800.839, 4323402.329)

Name of nearest waterbody: Banklick Creek

Identify (estimate) amount of waters in the review area:

Non-wetland waters: Total of 1400 linear feet (150 to 350 LF of ephemeral stream-drainage ditch and 1050 LF perennial stream- Banklick Creek)

Cowardin Class: Riverine
Stream Flow: Ephemeral and Perennial
Wetlands: 0 acres.

Name of any water bodies on the site that have been identified as Section 10 waters:

Tidal:

Non-Tidal: Banklick Creek

Activity Reference No.	Water Body	Latitude	Longitude	Water body type	Estimated amount of aquatic resource in review area	Cowardin Class	Class of Aquatic Resource
1	Drainage Ditch to Banklick Creek	39°02'05"N	84°30'24"W	Ephemeral	15 LF	Riverine	Non-Section 10- non-tidal

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☒ Office (Desk) Determination. Date: October 22, 2010

☐ Field Determination. Date(s):

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of

jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:Northern Kentucky Water District/Strand Associates.

☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

- ☒ Office concurs with data sheets/delineation report.
- ☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☐ U.S. Geological Survey Hydrologic Atlas: .

- ☐ USGS NHD data.

☐ USGS 8 and 12 digit HUC maps.
☒ U.S. Geological Survey map(s). Cite scale & quad name: Kenton, Kentucky
☐ USDA Natural Resources Conservation Service Soil Survey. Citation:
☐ National wetlands inventory map(s). Cite name: .
☐ State/Local wetland inventory map(s): .
☒ FEMA/FIRM maps: Community Panel 21117C0017E
☐ 100-year Floodplain Elevation is:
☒ Photographs: ☐ Aerial (Name & Date):
or ☐ Other (Name & Date):
☐ Previous determination(s). File no. and date of response letter: .
☐ Other information (please specify):

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

______________________	Darrell L. Edwards
Signature and date of Regulatory Project Manager (REQUIRED)	Signature and date of person requesting preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

$^{43}24^{000}$ M N

39° 01' 52.5"

$^{7}16^{000}$ M E

84° 30' 00.0"

MAP SCALE 1" = 500'

250 0 500 1000 FEET

METERS 0 150 300

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0017E

FIRM

FLOOD INSURANCE RATE MAP

KENTON COUNTY, KENTUCKY

AND INCORPORATED AREAS

PANEL 17 OF 141

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COVINGTON, CITY OF	210129	0017	E
FORT WRIGHT, CITY OF	210249	0017	E
KENTON VALE, CITY OF	210262	0017	E
PARK HILLS, CITY OF	210409	0017	E
TAYLOR MILL, CITY OF	210246	0017	E

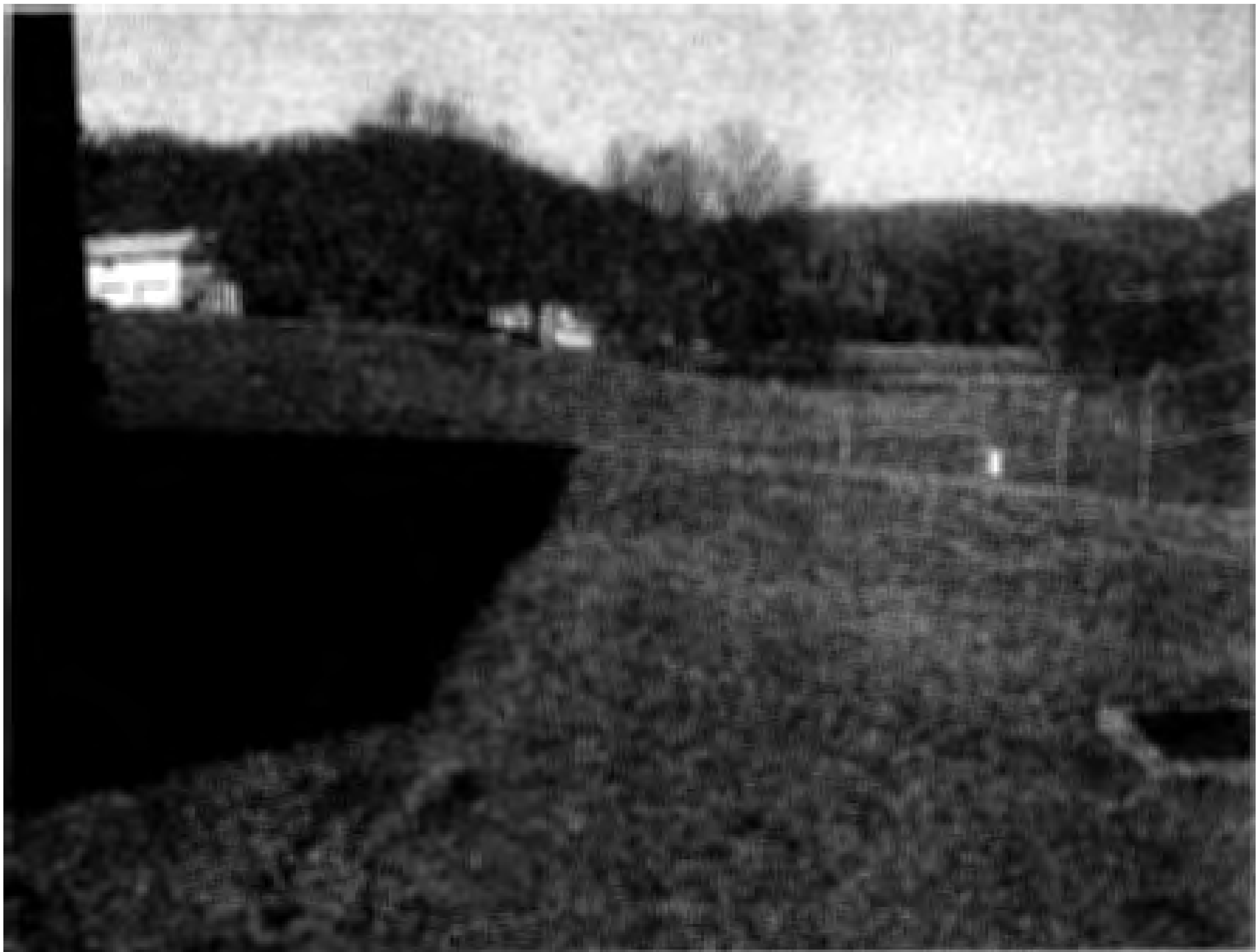
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
21117C0017E

EFFECTIVE DATE
MARCH 16, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



$^{43}24^{000}$ M N

39° 01' 52.5"

$^{7}15^{000}$ M E

JOINS PANEL 0019

$^{7}16^{000}$ M E

84° 30' 00.0"

MAP SCALE 1" = 500'

250 0 500 1000 FEET

0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

NFIP

PANEL 0017E

FIRM

FLOOD INSURANCE RATE MAP

KENTON COUNTY, KENTUCKY

AND INCORPORATED AREAS

PANEL 17 OF 141

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COVINGTON, CITY OF	210129	0017	E
FORT WRIGHT, CITY OF	210249	0017	E
KENTON VALE, CITY OF	210262	0017	E
PARK HILLS, CITY OF	210409	0017	E
TAYLOR MILL, CITY OF	210246	0017	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
21117C0017E

EFFECTIVE DATE
MARCH 16, 2009

Federal Emergency Management Agency

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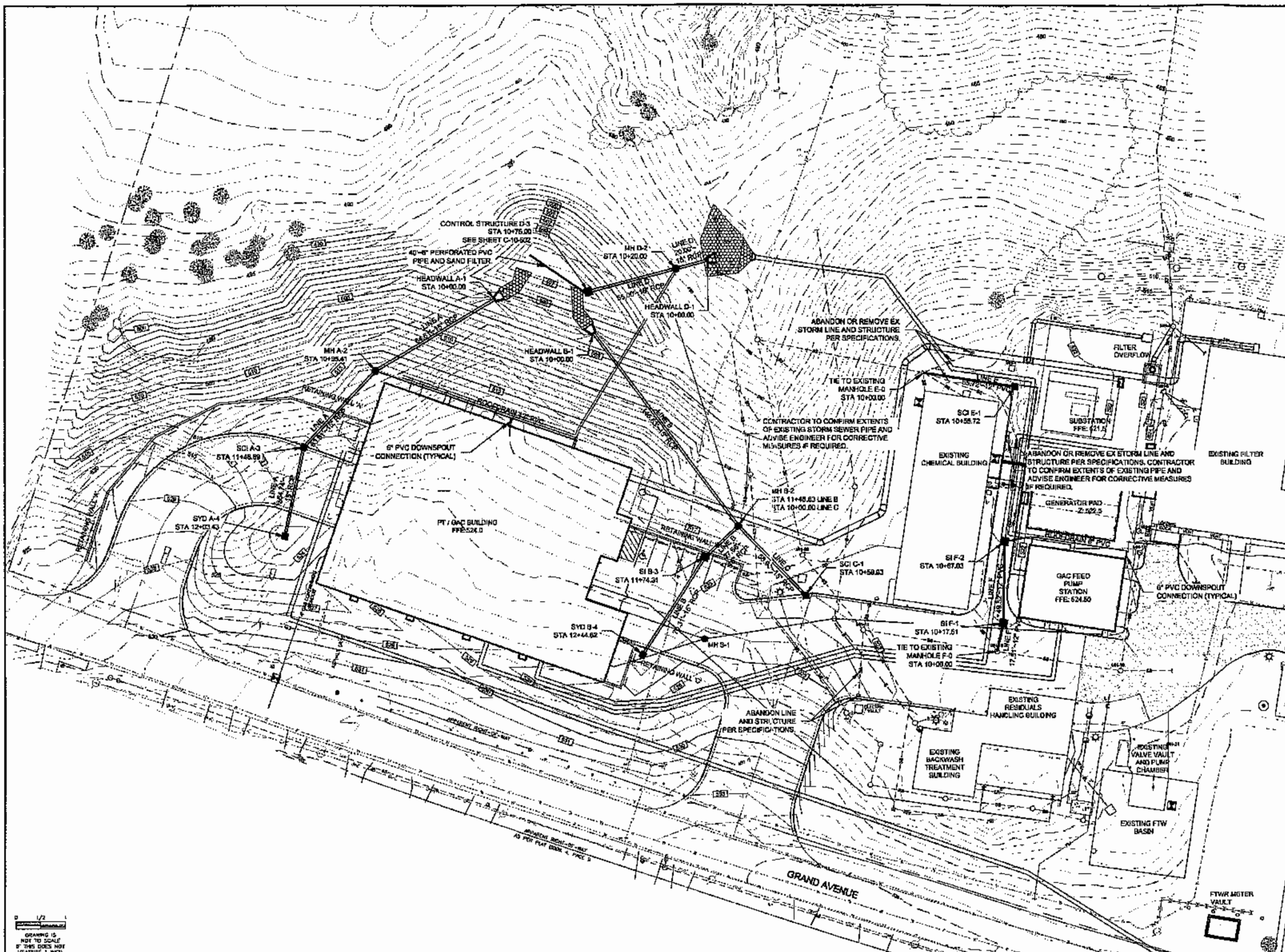


STORM SEWER NOTES:

BEFORE PROCEEDING WITH THE WORK, THE CONTRACTOR SHALL CONFER WITH ALL PUBLIC OR PRIVATE COMPANIES, AGENCIES, OR DEPARTMENTS THAT OWN AND OPERATE UTILITIES IN THE VICINITY OF THE CONSTRUCTION.

EXISTING UNDERGROUND UTILITIES AND SERVICES ARE SHOWN IN THEIR APPROXIMATE LOCATIONS ACCORDING TO AVAILABLE INFORMATION. THE LOCATIONS SHOWN ARE INTENDED ONLY AS A GUIDE AND CANNOT BE GUARANTEED ACCURATE.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR:

A. CONTACTING THE INDIVIDUAL UTILITY OWNERS TEN DAYS PRIOR TO CONSTRUCTION, ADVISING THEM OF THE WORK TO TAKE PLACE.
B. SOLICITING THEIR AID IN LOCATING AND PROTECTING ANY UTILITY WHICH MAY INTERFERE WITH CONSTRUCTION.
C. EXCAVATING AND VERIFYING THE HORIZONTAL AND VERTICAL LOCATION OF EACH UTILITY.
D. DAMAGE TO EXISTING UTILITIES DUE TO CONTRACTOR'S OPERATIONS.

CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE WHEN GAS LINES ARE EXPOSED WHICH CROSS OR LIE WITHIN 5' OF PUBLICLY MAINTAINED STORM AND SANITARY SEWER FACILITIES.

SD1 STANDARDS FOR CONSTRUCTION APPLY TO THE PUBLIC STORM SYSTEM. THE CONTRACTOR SHALL PERFORM ALL TESTING REQUIRED TO MEET THE APPROVAL OF THE SD1 AS PART OF THE LUMP SUM BID.

CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING DRAINAGE STRUCTURES TO MATCH FINISHED GRADE ELEVATIONS AS PART OF THE LUMP SUM BID.

ALL STORM MANHOLES ARE 4' DIAMETER UNLESS OTHERWISE NOTED.

PRIOR TO TESTING, ALL LINES SHALL BE RODDED OUT WITH THE APPROPRIATE TOOLS FOR THE REMOVAL OF ALL DIRT, TRASH, OR DEBRIS.

STORM SEWER PIPING SHALL BE TESTED IN ACCORDANCE WITH SD1 SPECIFICATIONS.

ALL TESTING MUST BE WITNESSED BY THE OWNERS REPRESENTATIVE. THE CONTRACTOR SHALL NOTIFY THE OWNERS REPRESENTATIVE OF HIS INTENTIONS TO CONDUCT PERFORMANCE TESTING AT LEAST 72 HOURS (3 DAYS) BEFORE ANY SCHEDULED TEST. RESULTS OF EACH TEST MUST BE PROVIDED TO THE OWNER, FOR THEIR RECORDS, AS WELL AS IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

DETAILED DESIGN AND CONSTRUCTION OF ALL PRECAST STRUCTURES IS THE RESPONSIBILITY OF THE CONTRACTOR. SD1 STANDARDS (OR OTHERS AS SPECIFIED) SHALL BE FOLLOWED FOR CONSTRUCTION OF ALL PRECAST STRUCTURES. IF PLAN CONFIGURATIONS PREVENT ADHERENCE TO THESE STANDARDS THE PRECASTER SHALL CONTACT THE OWNERS REPRESENTATIVE PRIOR TO FABRICATION OF THE STRUCTURE FOR DESIGN REVISIONS. THIS INCLUDES, BUT IS NOT LIMITED TO, PROVISION FOR GRADE RINGS TO ADJUST MANHOLE LIDS, MINIMUM ALLOWABLE DISTANCES BETWEEN OR ABOVE PIPES AND THE DISTANCE BETWEEN BOTTOM SLABS AND PIPE INVERTS.

COORDINATE REFERENCE TABLE

STRUCTURE	NORTHING	EASTING
A-1	559269.09	156734.74
A-2	559226.41	1567272.27
A-3	559179.18	1567228.59
A-4	559125.65	1567217.15
B-1	559248.54	1567404.24
B-2	559131.67	1567492.64
B-3	559112.68	156772.43
B-4	559053.54	1567434.42
C-1	559089.37	1567633.80
D-1	559292.38	1567473.86
D-2	559287.31	1567454.51
D-3	559273.40	1567401.29
E-1	559215.81	1567660.04
F-1	559072.63	1567663.01
F-2	559122.04	1567663.73

0 1/2 1
DRAWING IS NOT TO SCALE IF THIS DOES NOT MEASURE 1 INCH.

MALCOLM PIRNIE

STRAND ASSOCIATES, INC. ENGINEERS

REVISIONS			
NO.	BY	DATE	REMARKS

DES CJR
DWN CSD
CKD MAW

NORTHERN KENTUCKY WATER DISTRICT
TAYLOR MILL WATER TREATMENT PLANT

ADVANCED TREATMENT IMPROVEMENTS

CIVIL

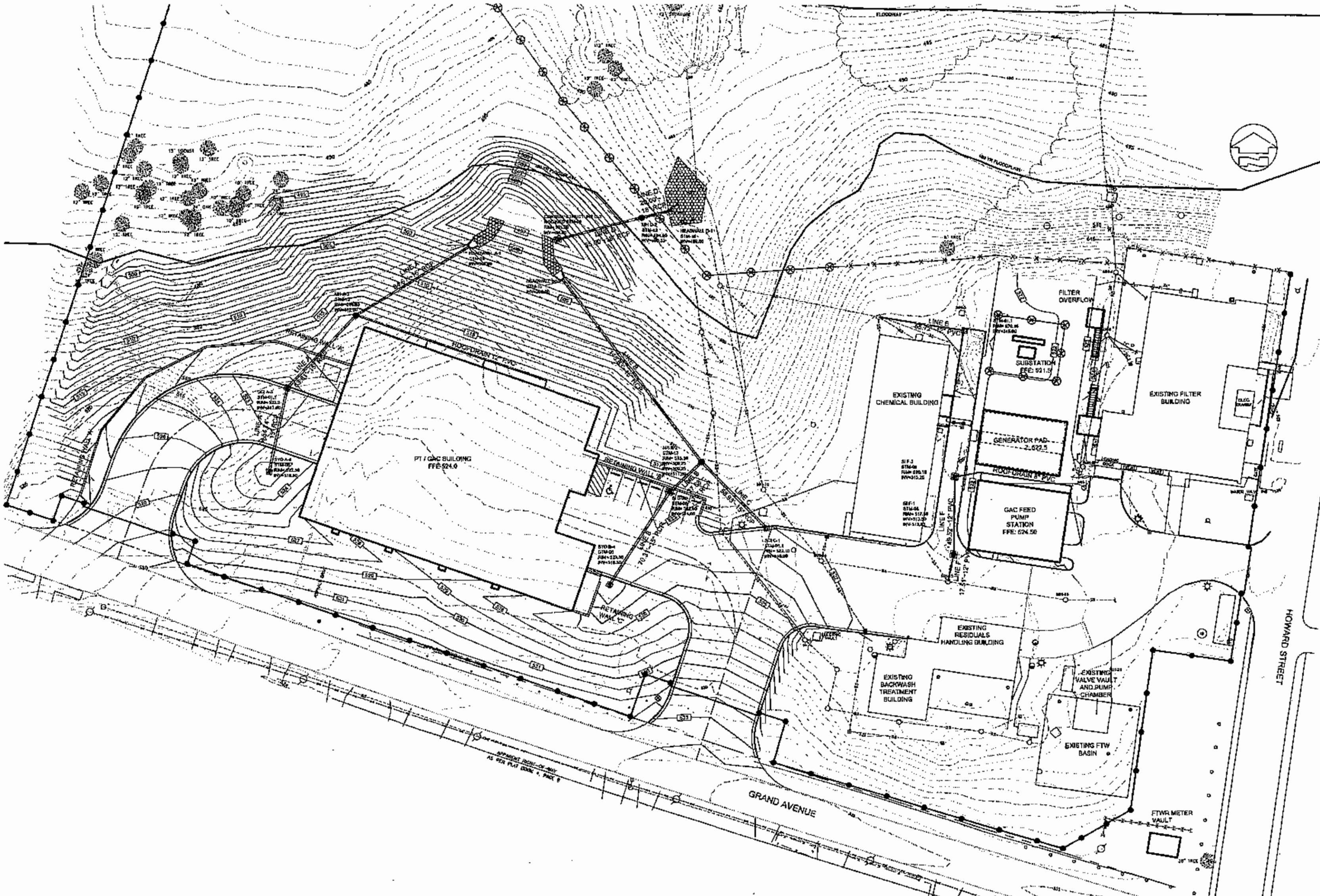
YARD PIPING - STORM SEWERS

SCALE: 1" = 30'

ISSUED STATUS: 100% SUBMITTAL
DATE OCTOBER, 2010
SHEET C-02-312
CAD REF. NO. STRAND-C-02-312

GENERAL NOTES:

1. CONTRACTOR TO REFER TO SHEET C-01-101 FOR COORDINATES AND ELEVATIONS THROUGHOUT THE SITE.
2. CONTRACTOR TO REFER TO SHEET C-01-105 FOR EROSION CONTROLS TO BE INSTALLED PRIOR TO LAND DISTURBING ACTIVITIES.
3. SITE PREPARATION WILL REQUIRE REMOVAL OF ALL VEGETATION, SURFACE ORGANIC SOILS, AND ANY OTHER SURFACE DELETERIOUS MATERIALS.
4. THE CONTRACTOR IS TO VERIFY THE EXACT LOCATION OF ALL EXISTING UTILITIES AND BENCHMARKS. TAKE CARE TO PROTECT UTILITIES THAT ARE TO REMAIN. REPAIR ANY DAMAGE ACCORDING TO LOCAL STANDARDS AND AT THE CONTRACTOR'S EXPENSE. COORDINATE ALL CONSTRUCTION WITH THE APPROPRIATE UTILITY COMPANY.
5. PROPOSED CONTOUR LINES AND SPOT ELEVATIONS ARE THE RESULT OF AN ENGINEERED GRADING DESIGN AND REFLECT A PLANNED INTENT WITH REGARD TO DRAINAGE AND MOVEMENT OF MATERIALS. SHOULD THE CONTRACTOR HAVE ANY QUESTIONS OF THE INTENT OR ANY PROBLEM WITH THE CONTINUITY OF GRADES, THE ENGINEER SHALL BE CONTACTED IMMEDIATELY.
6. THE CONTRACTOR SHALL CALL KENTUCKY ONE CALL (1-800-752-6007) 72 HOURS PRIOR TO PROCEEDING WITH ANY EXCAVATION.
7. ALL CUT AND FILL SLOPES SHALL BE 3.5 HORIZONTAL TO 1 VERTICAL OR FLATTER UNLESS OTHERWISE INDICATED ON THE PLANS.
8. POSITIVE DRAINAGE SHALL BE ESTABLISHED AS THE FIRST ORDER OF WORK AND SHALL BE MAINTAINED AT ALL TIMES DURING AND AFTER CONSTRUCTION. SOIL SOFTENED BY PERCHED WATER IN FOUNDATION AND PAVEMENT AREAS MUST BE UNDERCUT AND REPLACED WITH SUITABLE FILL MATERIALS APPROVED BY THE GEOTECHNICAL ENGINEER. GROUNDWATER INFILTRATION INTO EXCAVATIONS SHOULD BE EXPECTED, AND THE WATER SHALL BE REMOVED USING GRAVITY DRAINAGE OR PUMPING.



DRAWING IS NOT TO SCALE IF THIS DOES NOT MEASURE 1 INCH.

MALCOLM PIRNIE	DES ASC	NORTHERN KENTUCKY WATER DISTRICT TAYLOR MILL WATER TREATMENT PLANT ADVANCED TREATMENT IMPROVEMENTS
ENGINEERS - ARCHITECTS - PLANNERS	DWN ASC	CIVIL SITE GRADING PLAN SCALE: 1" = 30'
	CKD HHH	ISSUED STATUS: 100% SUBMITTAL DATE OCTOBER, 2010 SHEET C-01-102 CAD REF. NO. 3789-C-01-102

STRAND
ASSOCIATES, INC.®
ENGINEERS

Suite 100
1525 Bull Lea Road
Lexington, KY 40511
Phone: 859-225-8500
Fax: 859-225-8501

Office Locations

Madison, WI
Joliet, IL
Louisville, KY
Lexington, KY
Mobile, AL
Columbus, IN
Columbus, OH
Indianapolis, IN
Milwaukee, WI
Cincinnati, OH
Phoenix, AZ

www.strand.com

November 18, 2010

Mr. Jim Gruhala
U.S. Fish and Wildlife Service
J C Watts Federal Building, Room 265
330 W. Broadway
Frankfort, KY 40601-8670

Re: Proposed Taylor Mill Water Treatment Plant Expansion
Kenton County, Taylor Mill, Kentucky

Dear Jim,

On the behalf of our client, Northern Kentucky Water District, we request a confirmation of no effect for the proposed construction activities associated with the above-referenced project.

As mentioned in our phone conversation this morning, the United States Army Corps of Engineers (USACE) is processing a preconstruction notification request for a Nationwide Permit 7. I have attached a copy of the information submitted to the USACE for their processing. This information includes:

1. Copy of the USACE application
2. Permit Exhibits
3. Site Information
4. Photographs

Let me know if you need any additional information in order to issue the confirmation letter.

Sincerely,

STRAND ASSOCIATES, INC.®

Darrell A. Edwards

Darrell A. Edwards, P.E.

Enclosure(s)

c: Mike Hastings, U.S. Army Corps of Engineers
Amy Kramer, Northern Kentucky Water District
Alan Grant, KDOW Water Quality

DAE:clw\S:\CIN\1500--1599\1547\002\Wrd\Permit App & Submittal\Gruhala USFWS 102610.docx

U.S. Fish & Wildlife Service
Kentucky Ecological Services Field Office

U.S. Fish & Wildlife Service
330 West Broadway, Rm 265
Frankfort, KY 40601
Phone: 502-695-0468
Fax: 502-695-1024

Endangered, Threatened, & Candidate
Species in ____KENTON____________ County, KY

Group	Species	Common name	Legal* Status	Known** Potential	Special Comments
Mammals	*Myotis sodalis*	Indiana bat	E	P	
Mussels	*Epioblasma o. obliquata*	purple catspaw pearlymussel	E	K	
	Pleurobema clava	clubshell	E	K	
	Cyprogenia stegaria	fanshell	E	K	
	Epioblasma torulosa rangiana	Northern riffleshell	E	K	
	Plethobasus cooperianus	orangefoot pimpleback	E	K	
	Lampsilis abrupta	pink mucket	E	K	
	Obovaria retusa	ring pink	E	K	
	Pleurobema plenum	rough pigtoe	E	K	
	Plethobasus cyphyus	sheepnose	C	P	
Plants	*Trifolium stoloniferum*	running buffalo clover	E	K	

NOTES:

* Key to notations: E = Endangered, T = Threatened, C = Candidate, CH = Critical Habitat

**Key to notations: K = Known occurrence record within the county, P = Potential for the species to occur within the county based upon historic range, proximity to known occurrence records, biological, and physiographic characteristics.

184-457
permits
already scanned
of part on Policies

STEVEN L. BESHEAR
GOVERNOR

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER
200 FAIR OAKS LANE, 4TH FLOOR
FRANKFORT, KENTUCKY 40601
www.kentucky.gov

LEONARD K. PETERS
SECRETARY

STREAM CONSTRUCTION PERMIT

For Construction In Or Along A Stream

Issued to: **Northern KY Water District**
Address: **700 Alexander Pike**
Fort Thomas, KY 41075

Permit expires on
January 6, 2012

Permit No. **18914**

In accordance with KRS 151.250 and KRS 151.260, the Energy and Environment Cabinet approves the application dated **December 13, 2010** for **construction of two outfall headwalls and installation of rip rap for bank stabilization in the left descending floodplain of Banklick Creek, with coordinates 39.034722, -84.506667, in Kenton County.** AI: 33941

There shall be no deviation from the plans and specifications submitted and hereby approved unless the proposed change shall first have been submitted to and approved in writing by the Cabinet. This approval is subject to the attached limitations. **Please read these limitations carefully!** If you are unable to adhere to these limitations for any reason, please contact this office prior to construction.

This permit is valid from the standpoint of stream obstruction only. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits or licenses required by this Cabinet and other state, federal and local agencies. Specifically if the project involves work in a stream, such as bank stabilization, dredging, relocation, or in designated wetlands, a 401 Water Quality Certification from the Division of Water will be required.

This permit is nontransferable and is not valid unless actual construction of this authorized work is begun prior to the expiration date noted above. Any violation of the Water Resources Act of 1966 as amended is subject to penalties as set forth in KRS 151.990.

If you have any questions regarding this permit, please call Mr. Ross Bishop at (502) 564-3410.

Issued January 6, 2011.

Jeffrey W. Pratt

Jeffrey W. Pratt, P.E.
Environmental Engineering Consultant,
Director's Office, Division of Water

JP/RB/dg
pc: Florence Regional Office
Martin Scribner -Taylor Mill Floodplain Coordinator
File

Stream Construction Permit
Northern Kentucky Water District
Facility Requirements
Permit Number: 18914
Activity ID No.: APE20100001

STRC0000000001 (Headwalls) construction of two outfall headwalls and installation of rip rap for bank stabilization:

Submittal/Action Requirements:

Condition No.	Condition
S-1	Northern Kentucky Water District must submit final construction report: Due within 90 days after completion of construction Northern Kentucky Water District must notify in writing that the project has been completed in accordance with the approved plans and specifications. A Final Construction Report Form is enclosed. [401 KAR 4:060 Section 3(2)]

Narrative Requirements:

Condition No.	Condition
T-1	This permit is issued from the standpoint of stream obstruction only and does not constitute certification of any other aspect of the proposed construction. The applicant is liable for any damage resulting from the construction, operation, or maintenance of this project. This permit has been issued under the provisions of KRS Chapter 151.250 and regulations promulgated pursuant thereto. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits or licenses required by this Cabinet and other state, federal and local agencies. [KRS 151.250]
T-2	A copy of this permit must be available at the construction site. [KRS 151.250]
T-3	Any work performed by or for Northern Kentucky Water District that does not fully conform to the submitted application or drawings and the limitations set forth in this permit, is subject to partial or total removal and enforcement actions pursuant to KRS 151.280 as directed by the Kentucky Department for Environmental Protection. [KRS 151.280]
T-4	Any design changes or amendments to the approved plans must be submitted to the Division of Water and approved in writing prior to implementation. [KRS 151.250]
T-5	Since Kenton County participates in the National Flood Insurance Program, a local floodplain permit must be obtained prior to beginning of construction. Upon completion of construction Northern Kentucky Water District must contact the local permitting agency for final approval of the construction for compliance with the requirements of the local floodplain ordinance. [401 KAR 4:060 Section 1(16)]
T-6	Northern Kentucky Water District or his/her successor shall maintain the headwalls in good condition and keep it free of drift and debris at all times. [KRS 151.250, 401 KAR 4:060 Section 3(1)]
T-7	Permanent vegetation shall be established on fill as soon as possible upon completion of filling. [KRS 224.70-110]

STRC0000000001 (continued):

Narrative Requirements:

Condition No.	Condition
T-8	Erosion prevention measures, sediment control measures, and other site management practices shall be designed, installed, and maintained in an effective operating condition to prevent migration of sediment off site.
T-9	To avoid secondary adverse impacts, all materials used shall be stable and inert, free from pollutants and floatable objects, and shall meet all appropriate engineering standards. (Inert here means materials that are not chemically reactive and that will not rot or decompose, such as soil, rock, broken concrete or similar materials.). [401 KAR 4:060 Section 7]
T-10	Stream bank restoration and stabilization shall be limited to that necessary to restore the stream bank as closely as possible to its original location and configuration, and shall be completed without compromising the conveyance capacity of the stream at any time. [401 KAR 4:060]
T-11	All debris and excess material shall be removed for disposal outside of the base floodplain. [401 KAR 4:060]
T-12	Upon completion of construction all disturbed areas shall be seeded and mulched or otherwise stabilized to prevent erosion. [401 KAR 4:060]
T-13	The entry of mobile equipment into the stream channel shall be limited as much as reasonably possible to minimize degradation of the waters of the Commonwealth. [401 KAR 4:060]
T-14	Construction other than as authorized by this permit shall require written approval from the Division of Water. [401 KAR 4:060]
T-15	Due to the nature of the work involved in the proposed project, the Division of Water has waived the requirement that the submitted plans and specifications be drawn by an engineer, licensed to practice as a professional engineer in the state of Kentucky, under the provisions of the KRS Chapter 322. [KRS 151.250, KRS 151.260]

FINAL CONSTRUCTION REPORT

NAME:____________________________________

PERMIT NO: 18914

AI: 33941

Has all work on this project been completed according to the plans and specifications on file with the Division of Water?

Yes:________

No:________ If no, explain. You may mail an attachment if necessary.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
P.O. BOX 59
LOUISVILLE, KENTUCKY 40201-0059

184-457
permits

RECEIVED
JAN - 5 2011
ENGINEERING DEPT.

January 3, 2011

Operations Division
Regulatory Branch (South)
ID No. LRL-2010-1129-mlc

Mr. Christopher Dent
Strand Associates, Inc.
1525 Bull Lea Road, Suite 100
Lexington, Kentucky 40511

Dear Mr. Dent:

This is in response to your request on behalf of the Northern Kentucky Water District for authorization to install two outfall structures for the Taylor Mill Water Treatment Plant Site. The two concrete outfall structures would be located on an unnamed ephemeral tributary to Banklick Creek located on the property at 602 and 632 Grand Avenue, Taylor Mill, Kentucky. The outfall structures would accommodate 18-inch and 24-inch diameter storm sewers and would involve 7 cubic yards of rip rap placed in the unnamed ephemeral tributary to Banklick Creek. You are reminded that this authorization does not obviate the need to obtain other permits from state or local agencies. The information supplied by you was reviewed to determine whether a Department of the Army (DA) permit will be required under the provisions of Section 404 of the Clean Water Act.

This project is considered a discharge of backfill or bedding material for utility lines including outfall structures. The project is authorized under the provisions of 33 CFR 330 Nationwide Permit (NWP) No. 12, Utility Line Activities, as published in the Federal Register March 12, 2007. Under the provisions of this authorization the Northern Kentucky Water District must comply with the enclosed:

1. Terms for Nationwide Permit No. 12;

2. Nationwide Permit General Conditions; and

3. Water Quality Certification (WQC) Conditions for Nationwide Permit No. 12 dated March 19, 2007, issued by the Kentucky Division of Water.

Once you obtain your certification, or if no application was required, you may proceed with the project without further contact or verification from us.

This verification is valid until the NWP is modified, reissued, or revoked. All of the existing NWPs are scheduled to be modified, reissued, or revoked prior to March 18, 2012. It is incumbent upon the Northern Kentucky Water District to remain informed of changes to the NWPs. We will issue a public notice when the NWPs are reissued. Furthermore, if the Northern Kentucky Water District commences or are under contract to commence this activity before the date that the relevant nationwide permit is modified or revoked, they will have twelve (12) months from the date of the modification or revocation of the NWP to complete the activity under the present terms and conditions of this nationwide permit. The enclosed Compliance Certification should be signed and returned when the project is completed. If the project is not completed within this time frame or if the project is modified, the Northern Kentucky Water District must contact us for another permit determination. A copy of this letter is being sent to the applicant the Northern Kentucky Water District and to the Kentucky Division of Water (KDOW).

If you have any questions, please contact this office by writing to the above address, ATTN: CELRL-OP-FS, or by calling Ms. Meagan Chapman 502-315-6709. All correspondence pertaining to this matter should refer to our ID No. LRL-2010-1129-mlc.

Sincerely,

Original Signed

Lee Anne Devine
Chief, South Section
Regulatory Branch

Enclosures

ADDRESS FOR COORDINATING AGENCY

Ms. Sandra Gruzesky, Director
Kentucky Energy and Environment Cabinet
Division of Water
200 Fair Oaks, 4th Floor
Frankfort, KY 40601

ADDRESS FOR APPLICANT

Ms. Amy Kramer
Northern Kentucky Water District
2835 Crescent Springs Road
P.O. Box 18640
Erlanger, KY 41018

EXHIBIT 7d and 7e
BUILDING PERMIT APPLICATION

NKAPC Northern Kentucky Area Planning Commission

COMMERCIAL JOINT APPLICATION FOR ZONING/BUILDING PERMITS

2332 Royal Drive, Ft. Mitchell, KY P) 859-331-8980 F) 859-331-8987 www.nkapc.org

Do you wish for this application to be processed as a fast track? X No ☐ Yes (1-1/2 times the normal fee, due with application)

Is this project required to be licensed by the Cabinet for Health and Family Services (CHFS)?

X No ☐ Yes; License number: ____

County and address of proposed activity: Kenton Co., 608 Grand Ave, Taylor Mill, KY 41015 Suite #: NA

Name of strip center or building where the project is located: Taylor Mill advanced Water Treatment Facility

Business name: ~~Filter Building and adjoining~~ Chemical Building

Property Identification Number (PIDN): 056-20-02-027.02 Subdivision: Kollman's Grand Ave. Resubdivision Lot: 6,7,8,9,10

	Property Owner	Plans By	Contractor / Builder	Applicant
Contact	Amy Kramer	James K. Piper Jr., AIA	TBD	Amy Kramer
Company	Northern Ky Water District	GRW Engineers, Inc.		Northern Ky Water District
Address	2835 Crescent Springs Rd.	801 Corporate Drive		2835 Crescent Springs Rd.
City	Erlanger	Lexington		Erlanger
State	Kentucky	Kentucky		Kentucky
ZIP Code	41018	40503		41018
Phone #	859-426-2734	859-223-3999		859-426-2734
Fax #	859-578-7893	859-219-9059		859-578-7893
Cel #	859-991-1617	859-338-5842		859-991-1617
Email	akramer@nkywater.org	jpiper@grwinc.com		akramer@nkywater.org
Occupational License #	N/A	N/A		36785500
Fed Tax ID #	N/A	N/A		611311695

Proposed building activity (Required to be completed):

- ☐ New building
- ☐ Addition to building
- X Alteration to building
- ☐ Demolition of building
- ☐ Accessory structure
- ☐ Building shell permit
- ☐ Fire suppression
- ☐ Retaining wall
- ☐ Other: ____
- ☐ Repair / Replacement
- ☐ Agriculture / Farm exemption
- ☐ Off-street parking / Unloading facility
- ☐ Change of use or occupancy
- ☐ Driveway / Access point
- ☐ Footer / Foundation and site work only
- ☐ Fire alarm
- ☐ Modular building
- ☐ Fence
  - Type: ____
  - Height: ____
  - ☐ Pool enclosure?
- ☐ Sign
  - ☐ New
  - ☐ Face change

Current use of property: Water Treatment Facility

Proposed use of property: Water Treatment Facility

Description of construction activity to be performed: Demotion of a tunnel, construction of new exterior walls to patch location of demoed tunnel, & ~~as well as the construction of an exterior stair and interior partition wall~~ ~~Filter Building~~

Overall estimated cost: $ 107,910.00 Square footage of new project: NA per floor: NA

Encroachment permit required? ☒ No ☐ Yes; by which agency? ______

Type of sewage disposal: ☒ Public or centralized ☐ On-site (septic tank): Sewer permit number ______

Type of water supply: ☒ Public ☐ Private (well, cistern)

HVAC: Contractor: TBD License number: TBD

Is HVAC drawing included with this application? ☒ Yes ☐ No: Separate permit required

What is the estimated value of the HVAC? $ TBD

Is the project located within the floodplain? ☒ No ☐ Yes; Panel#: ______

Is the project located on an original hillside slope of twenty (20) percent or greater? ☐ Yes ☒ No

How much land area is being disturbed for the proposed project? .08 acres

Registered Design Professional in responsible charge: James K. Piper Jr., AIA, Lead Architect, GRW Engineers, Inc.

If the Registered Design Professional in responsible charge is an architect, is this individual responsible for construction contract administration? ☐ Yes ☒ No

Existing use of building and/or space information:
Building square feet: NA Number of stories: NA Construction type: NA
Square feet per floor: NA Existing use: NA Building suppression (sprinkler): ☐ Yes ☐ No

No work shall be started until proper permits have been issued. Fees are non-refundable. All actions taken in connection with this application are based on the representations by the applicant that the submitted information and attachments are correct and accurate and the burden of proof of its correctness and accuracy is the responsibility of the applicant. The applicant is responsible for meeting all requirements of the Kentucky Building Code and local zoning ordinances.

Owner or Authorized Agent (Signature): ______ Date: ______

Owner or Authorized Agent (Please print): ______

To be completed by Administrative Official

Application #: TAA1011000109 Date Received: 11.12.10

			App.	App. With Conditions	Disapp.
SIC Code:	Zoning fee: N/A	Zoning	N/A		11-29-10
Zone:	Building fee: 1068.00	Building			12-8-10 TmT
BOA#:	HVAC fee: 294.00	HVAC			
Stage 1/11DP:	Other:	Permit issued:			
	Total: 1597.00	Certificate of Occupancy issued:			

Date: 11-12-10 Amount paid: 1,068.00 Method: CK 2105

Date: ______ Amount paid: ______ Method: ______

Signature of Administrative Official: [signature]

NKAPC Northern Kentucky Area Planning Commission

COMMERCIAL JOINT APPLICATION FOR ZONING/BUILDING PERMITS

2332 Royal Drive, Ft. Mitchell, KY P) 859-331-8980 F) 859-331-8987 www.nkapc.org

Do you wish for this application to be processed as a fast track? X No ☐ Yes (1-1/2 times the normal fee, due with application)

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	Property Owner	Plans By	Contractor / Builder	Applicant
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Company	Northern Ky Water District	GRW Engineers, Inc.		Northern Ky Water District
Address	2835 Crescent Springs Rd.	801 Corporate Drive		2835 Crescent Springs Rd.
City	Erlanger	Lexington		Erlanger
State	Kentucky	Kentucky		Kentucky
ZIP Code	41018	40503		41018
Phone #	859-426-2734	859-223-3999		859-426-2734
Fax #	859-578-7893	859-219-9059		859-578-7893
Cel #	859-991-1617	859-338-5842		859-991-1617
Email	akramer@nkywater.org	jpiper@grwinc.com		akramer@nkywater.org
Occupational License #	N/A	N/A		36785500
Fed Tax ID #	N/A	N/A		611311695

Proposed building activity (Required to be completed):

- ☐ New building
- ☐ Addition to building
- ☐ Alteration to building
- ☐ Demolition of building
- ☐ Accessory structure
- ☐ Building shell permit
- ☐ Fire suppression
- X Retaining wall
- ☐ Other: ________
- ☐ Repair / Replacement
- ☐ Agriculture / Farm exemption
- ☐ Off-street parking / Unloading facility
- ☐ Change of use or occupancy
- ☐ Driveway / Access point
- ☐ Footer / Foundation and site work only
- ☐ Fire alarm
- ☐ Modular building
- ☐ Fence
  - Type: ________
  - Height: ________
  - ☐ Pool enclosure?
- ☐ Sign
  - ☐ New
  - ☐ Face change

Current use of property: Vacant Lot

Proposed use of property: Water Treatment Facility

Description of construction activity to be performed: The construction of (3) retaining walls.

Overall estimated cost: $ 82,280.00 Square footage of new project: 344 LF per floor: ________

A - 227 LF
B - 84 LF
C - 33 LF

Encroachment permit required? ☒ No ☐ Yes; by which agency? ______

Type of sewage disposal: ☒ Public or centralized ☐ On-site (septic tank): Sewer permit number ______

Type of water supply: ☒ Public ☐ Private (well, cistern)

HVAC: Contractor: NA Licence number: NA

Is HVAC drawing included with this application? ☐ Yes ☒ No; Separate permit required

What is the estimated value of the HVAC? $ NA

Is the project located within the floodplain? ☒ No ☐ Yes; Panel#: ______

Is the project located on an original hillside slope of twenty (20) percent or greater? ☒ Yes ☐ No

How much land area is being disturbed for the proposed project? 1.08 acres

Registered Design Professional in responsible charge: James K. Piper Jr., AIA, Lead Architect, GRW Engineers, Inc.

If the Registered Design Professional in responsible charge is an architect, is this individual responsible for construction contract administration? ☐ Yes ☒ No

Existing use of building and/or space information:
Building square feet: NA Number of stories: NA Construction type: NA
Square feet per floor: NA Existing use: NA Building suppression (sprinkler): ☐ Yes ☐ No

No work shall be started until proper permits have been issued. Fees are non-refundable. All actions taken in connection with this application are based on the representations by the applicant that the submitted information and attachments are correct and accurate and the burden of proof of its correctness and accuracy is the responsibility of the applicant. The applicant is responsible for meeting all requirements of the Kentucky Building Code and local zoning ordinances.

Owner or Authorized Agent (Signature): JKPjr Date: 2/18/11

Owner or Authorized Agent (Please print): James K. Piper Jr.

To be completed by Administrative Official

Application #: 21'TM11030061 Date Received: 3-14-11

$182 x 2 = 372.00

			App.	App. With Conditions	Disapp.
SIC Code: ______	Zoning fee: ______	Zoning	______	______	______
Zone: ______	Building fee: $372.00	Building	Tim T 3.21.11	______	______
BOA#: ______	HVAC fee: ______	HVAC	______	______	______
Stage I/II DP: ______	Other: ______	Permit issued: ______			
295' wall > 4'	Total: ______	Certificate of Occupancy issued: ______			

Date: ______ Amount paid: ______ Method: ______

Date: ______ Amount paid: ______ Method: ______

Signature of Administrative Official: ______

COMMERCIAL JOINT APPLICATION FOR ZONING/BUILDING PERMITS

NKAPC Northern Kentucky Area Planning Commission
2332 Royal Drive, Ft. Mitchell, KY P) 859-331-8980 F) 859-331-8987 www.nkapc.org

Do you wish for this application to be processed as a fast track? ☒ No ☐ Yes (1-1/2 times the normal fee, due with application)

Is this project required to be licensed by the Cabinet for Health and Family Services (CHFS)?

☒ No ☐ Yes; License number: ______

County and address of proposed activity: Kenton Co., 608 Grand Ave, Taylor Mill, KY 41015 Suite #: NA

Name of strip center or building where the project is located: Taylor Mill advanced Water Treatment Facility

Business name: GAC Feed Pump Station

Property Identification Number (PIDN): 056-20-02-027.02 Subdivision: Kollman's Grand Ave. Resubdivision Lot: 12 & 11

	Property Owner	Plans By	Contractor / Builder	Applicant
Contact	Amy Kramer	James K. Piper Jr., AIA	TBD	Amy Kramer
Company	Northern Ky Water District	GRW Engineers, Inc.		Northern Ky Water District
Address	2835 Crescent Springs Rd.	801 Corporate Drive		2835 Crescent Springs Rd.
City	Erlanger	Lexington		Erlanger
State	Kentucky	Kentucky		Kentucky
ZIP Code	41018	40503		41018
Phone #	859-426-2734	859-223-3999		859-426-2734
Fax #	859-578-7893	859-219-9059		859-578-7893
Cell #	859-991-1617	859-338-5842		859-991-1617
Email	akramer@nkywater.org	jpiper@grwinc.com		akramer@nkywater.org
Occupational License #	N/A	N/A		36785500
Fed Tax ID #	N/A	N/A		611311695

Proposed building activity (Required to be completed):

- ☒ New building
- ☐ Addition to building
- ☐ Alteration to building
- ☐ Demolition of building
- ☐ Accessory structure
- ☐ Building shell permit
- ☐ Fire suppression
- ☐ Retaining wall
- ☐ Repair / Replacement
- ☐ Agriculture / Farm exemption
- ☐ Off-street parking / Unloading facility
- ☐ Change of use or occupancy
- ☐ Driveway / Access point
- ☐ Footer / Foundation and site work only
- ☐ Fire alarm
- ☐ Modular building
- ☐ Fence
  - Type: ______
  - Height: ______
  - ☐ Pool enclosure?
- ☐ Sign
  - ☐ New
  - ☐ Face change
- ☐ Other: ______

Current use of property: Water Treatment Facility

Proposed use of property: Water Treatment Facility

Description of construction activity to be performed: New structure to be built on site.

Overall estimated cost: $ 866,733.75 Square footage of new project: 2,588 SF per floor: EL. 524.50 - 2,588 SF

Note: Estimate does not include equipement.

Encroachment permit required? ☒ No ☐ Yes; by which agency? ____

Type of sewage disposal: ☒ Public or centralized ☐ On-site (septic tank): Sewer permit number ____

Type of water supply: ☒ Public ☐ Private (well, cistern)

HVAC: Contractor: TBD License number: TBD

Is HVAC drawing included with this application? ☒ Yes ☐ No: Separate permit required

What is the estimated value of the HVAC? $ TBD

Is the project located within the floodplain? ☒ No ☐ Yes; Panel#: ____

Is the project located on an original hillside slope of twenty (20) percent or greater? ☐ Yes ☒ No

How much land area is being disturbed for the proposed project? .04 acres

Registered Design Professional in responsible charge: James K. Piper Jr., AIA, Lead Architect, GRW Engineers, Inc.

If the Registered Design Professional in responsible charge is an architect, is this individual responsible for construction contract administration? ☐ Yes ☒ No

Existing use of building and/or space information:
Building square feet: 24,472 SF Number of stories: 3 Construction type: 2B
Square feet per floor: * Existing use: F2 Building suppression (sprinkler): ☐ Yes ☒ No
* Filter Bldg.: @ El. 510.7 - 8400 SF, @ El. 525.5 - 20096 SF, @ El. 535 - 8400 SF, @ El. 545 - 3167 SF

No work shall be started until proper permits have been issued. Fees are non-refundable. All actions taken in connection with this application are based on the representations by the applicant that the submitted information and attachments are correct and accurate and the burden of proof of its correctness and accuracy is the responsibility of the applicant. The applicant is responsible for meeting all requirements of the Kentucky Building Code and local zoning ordinances.

Owner or Authorized Agent (Signature): JKP Date: 2/1/2011

Owner or Authorized Agent (Please print): James K. Piper Jr.

To be completed by Administrative Official

Application #: SP110800027 Date Received: 2-9-11

				App.	App. With Conditions	Disapp.
SIC Code:	Zoning fee: N/A	Zoning		Exempt		
Zone: R-1F	Building fee: $426.00	Building			TimT 3-22-11	2.14.11 TimT 3.14.11 TimT
BOA#:	HVAC fee: $294.00	HVAC				
Stage 1/11DP:	Other: $235.00	Permit issued:				
3rd Plan	Total: $955.00	Certificate of Occupancy issued:				

Date: 2-9-11 Amount paid: 426.00 Method: CK 2208

Date: ____ Amount paid: ____ Method: ____

Signature of Administrative Official: [signature]

NKAPC 09/10

NKAPC Northern Kentucky Area Planning Commission

COMMERCIAL JOINT APPLICATION FOR ZONING/BUILDING PERMITS

2332 Royal Drive, Ft. Mitchell, KY P) 859-331-8980 F) 859-331-8987 www.nkapc.org

Do you wish for this application to be processed as a fast track? ☒ No ☐ Yes (1-1/2 times the normal fee, due with application)

Is this project required to be licensed by the Cabinet for Health and Family Services (CHFS)?

☒ No ☐ Yes; License number: ______

County and address of proposed activity: Kenton Co., 608 Grand Ave, Taylor Mill, KY 41015 Suite #: NA

Name of strip center or building where the project is located: Taylor Mill advanced Water Treatment Facility

Business name: PT / GAC Building

Property Identification Number (PIDN): 056-20-02-027.02 Subdivision: Kollman's Grand Ave. Resubdivision Lot: 16,17,18,19

	Property Owner	Plans By	Contractor / Builder	Applicant
Contact	Amy Kramer	James K. Piper Jr., AIA	TBD	Amy Kramer
Company	Northern Ky Water District	GRW Engineers, Inc.		Northern Ky Water District
Address	2835 Crescent Springs Rd.	801 Corporate Drive		2835 Crescent Springs Rd.
City	Erlanger	Lexington		Erlanger
State	Kentucky	Kentucky		Kentucky
ZIP Code	41018	40503		41018
Phone #	859-426-2734	859-223-3999 - 338 5842		859-426-2734
Fax #	859-578-7893	859-219-9059		859-578-7893
Cel #	859-991-1617	859-338-5842		859-991-1617
Email	akramer@nkywater.org	jpiper@grwinc.com		akramer@nkywater.org
Occupational License #	N/A	N/A		36785500
Fed Tax ID #	N/A	N/A		611311695

Proposed building activity (Required to be completed):

- ☒ New building
- ☐ Addition to building
- ☐ Alteration to building
- ☐ Demolition of building
- ☐ Accessory structure
- ☐ Building shell permit
- ☐ Fire suppression
- ☐ Retaining wall
- ☐ Other: ______
- ☐ Repair / Replacement
- ☐ Agriculture / Farm exemption
- ☐ Off-street parking / Unloading facility
- ☐ Change of use or occupancy
- ☐ Driveway / Access point
- ☐ Footer / Foundation and site work only
- ☐ Fire alarm
- ☐ Modular building
- ☐ Fence
  - Type: ______
  - Height: ______
  - ☐ Pool enclosure?
- ☐ Sign
  - ☐ New
  - ☐ Face change

Current use of property: Vacant Lot

Proposed use of property: Water Treatment Facility

Description of construction activity to be performed: New structure to be built on site.

Overall estimated cost: $ 6,996,531.25 Square footage of new project: 21,743 SF per floor:

Note: Estimate does not include equipment.

EL. 524.00 - 13,320 SF
EL. 537.00 - 8,000 SF
EL. 545.66 - 423 SF

Encroachment permit required? ☒ No ☐ Yes; by which agency? ____________

Type of sewage disposal: ☒ Public or centralized ☐ On-site (septic tank): Sewer permit number ____________

Type of water supply: ☒ Public ☐ Private (well, cistern)

HVAC: Contractor: TBD License number: TBD

Is HVAC drawing included with this application? ☒ Yes ☐ No: Separate permit required

What is the estimated value of the HVAC? $ TBD

Is the project located within the floodplain? ☒ No ☐ Yes; Panel#: ____________

Is the project located on an original hillside slope of twenty (20) percent or greater? ☒ Yes ☐ No

How much land area is being disturbed for the proposed project? 3 acres

Registered Design Professional in responsible charge: James K. Piper Jr., AIA, Lead Architect, GRW Engineers, Inc.

If the Registered Design Professional in responsible charge is an architect, is this individual responsible for construction contract administration? ☐ Yes ☒ No

Existing use of building and/or space information:

Building square feet: NA Number of stories: NA Construction type: NA

Square feet per floor: NA Existing use: NA Building suppression (sprinkler): ☐ Yes ☐ No

No work shall be started until proper permits have been issued. Fees are non-refundable. All actions taken in connection with this application are based on the representations by the applicant that the submitted information and attachments are correct and accurate and the burden of proof of its correctness and accuracy is the responsibility of the applicant. The applicant is responsible for meeting all requirements of the Kentucky Building Code and local zoning ordinances.

Owner or Authorized Agent (Signature): ____________ Date: ____________

Owner or Authorized Agent (Please print): ____________

To be completed by Administrative Official

Application #: TAA10110070 Date Received: 11-12-10

				App.	App. With Conditions	Disapp.
SIC Code: ____	Zoning fee: N/A	Zoning		N/A		11-29-10 TimT
Zone: ____	Building fee: 3745.44	Building			Tim 3-24-11	12-9-10 TimT
BOA#: ____	HVAC fee: 294.00	HVAC				
Stage I/IIDP: ____	Other: 235.00	Permit issued:				
2+ Plan Review	Total: 4274.44	Certificate of Occupancy issued:				

Date: 11-12-10 Amount paid: 1,068.00 Method: CK 2164

Date: ____________ Amount paid: ____________ Method: ____________

Signature of Administrative Official: [signature]

NKAPC Northern Kentucky Area Planning Commission

COMMERCIAL JOINT APPLICATION FOR ZONING/BUILDING PERMITS

2332 Royal Drive, Ft. Mitchell, KY P) 859-331-8980 F) 859-331-8987 www.nkapc.org

Do you wish for this application to be processed as a fast track? ☒ No ☐ Yes (1-1/2 times the normal fee, due with application)

Is this project required to be licensed by the Cabinet for Health and Family Services (CHFS)?

☒ No ☐ Yes; License number: ______

County and address of proposed activity: Kenton Co., 608 Grand Ave, Taylor Mill, KY 41015 Suite #: NA

Name of strip center or building where the project is located: Taylor Mill advanced Water Treatment Facility

Business name: Filter Building

Property Identification Number (PIDN): 056-20-02-027.02 Subdivision: Kollman's Grand Ave. Resubdivision Lot: 6,7,8,9,10

	Property Owner	Plans By	Contractor / Builder	Applicant
Contact	Amy Kramer	James K. Piper Jr., AIA	TBD	Amy Kramer
Company	Northern Ky Water District	GRW Engineers, Inc.		Northern Ky Water District
Address	2835 Crescent Springs Rd.	801 Corporate Drive		2835 Crescent Springs Rd.
City	Erlanger	Lexington		Erlanger
State	Kentucky	Kentucky		Kentucky
ZIP Code	41018	40503		41018
Phone #	859-426-2734	859-223-3999		859-426-2734
Fax #	859-578-7893	859-219-9059		859-578-7893
Cel #	859-991-1617	859-338-5842		859-991-1617
Email	akramer@nkywater.org	jpiper@grwinc.com		akramer@nkywater.org
Occupational License #	N/A	N/A		36785500
Fed Tax ID #	N/A	N/A		611311695

Proposed building activity (Required to be completed):

- ☐ New building
- ☐ Addition to building
- ☒ Alteration to building
- ☐ Demolition of building
- ☐ Accessory structure
- ☐ Building shell permit
- ☐ Fire suppression
- ☐ Retaining wall
- ☐ Repair / Replacement
- ☐ Agriculture / Farm exemption
- ☐ Off-street parking / Unloading facility
- ☐ Change of use or occupancy
- ☐ Driveway / Access point
- ☐ Footer / Foundation and site work only
- ☐ Fire alarm
- ☐ Modular building
- ☐ Fence
  - Type: ______
  - Height: ______
  - ☐ Pool enclosure?
- ☐ Sign
  - ☐ New
  - ☐ Face change
- ☐ Other: ______

Current use of property: Water Treatment Facility.

Proposed use of property: Water Treatment Facility

Description of construction activity to be performed: Demotion of a tunnel, construction of new exterior walls to patch location of demoed tunnel, as well as, the construction of an exterior stair and interior partition wall.

Overall estimated cost: $ 107,910.00 Square footage of new project: NA per floor: NA

Encroachment permit required? ☒ No ☐ Yes; by which agency? ______

Type of sewage disposal: ☒ Public or centralized ☐ On-site (septic tank): Sewer permit number ______

Type of water supply: ☒ Public ☐ Private (well, cistern)

HVAC: Contractor: TBD License number: TBD

Is HVAC drawing included with this application? ☒ Yes ☐ No: Separate permit required

What is the estimated value of the HVAC? $ TBD

Is the project located within the floodplain? ☒ No ☐ Yes; Panel#: ______

Is the project located on an original hillside slope of twenty (20) percent or greater? ☐ Yes ☒ No

How much land area is being disturbed for the proposed project? .04 acres

Registered Design Professional in responsible charge: James K. Piper Jr., AIA, Lead Architect, GRW Engineers, Inc.

If the Registered Design Professional in responsible charge is an architect, is this individual responsible for construction contract administration? ☐ Yes ☒ No

Existing use of building and/or space information:

Building square feet: Chemcial Bldg. - 6094 SF; Filter Bldg. - 40063 SF Number of stories: Chemical Bldg. - 1; Filter Bldg. - 3 Construction type: Chemical Bldg. - 2B Noncombustible Protected; Filter Bldg. - 2B

Square feet per floor: * Existing use: Chemical Bldg. - H-4; Filter Bldg. - F2 Building suppression (sprinkler): ☐ Yes ☐ No Chemical Bldg. - YES; Filter Bldg. - NO

* Chemical Bldg.: @ El. 521.8 - 6,094 SF
Filter Bldg.: @ El. 510.7 - 8400 SF, @ El. 525.5 - 20096 SF, @ El. 535 - 8400 SF, @ El. 545 - 3167 SF

No work shall be started until proper permits have been issued. Fees are non-refundable. All actions taken in connection with this application are based on the representations by the applicant that the submitted information and attachments are correct and accurate and the burden of proof of its correctness and accuracy is the responsibility of the applicant. The applicant is responsible for meeting all requirements of the Kentucky Building Code and local zoning ordinances.

Owner or Authorized Agent (Signature): ______ Date: ______

Owner or Authorized Agent (Please print): ______

To be completed by Administrative Official

Application #: TU10110008 Date Received: 11-18-10

			App.	App. With Conditions	Disapp.
SIC Code: ____	Zoning fee: N/A	Zoning	N/A		
Zone: ____	Building fee: 426	Building		Tim 3-28-11	
BOA#: ____	HVAC fee: 294	HVAC			
Stage 1/IIDP: ____	Other: 3rd Plan 235	Permit issued:			
	Total: 955.00	Certificate of Occupancy issued:			

Date: 11-15-10 Amount paid: $426.00 Method: CK 21166

Date: ______ Amount paid: ______ Method: ______

Signature of Administrative Official: [signature]

NKAPC 9/10

EXHIBIT 7f
PLUMBING PERMIT APPLICATION

801 Corporate Drive
Lexington, KY 40503
Tel 859 / 223-3999
Fax 859 / 223-8917

GRW Engineers, Inc.

Engineering
Architecture
Planning
GIS
Aviation Consultants

Arlington, TX
Cincinnati, OH
Columbus, OH
Indianapolis, IN
Knoxville, TN
Louisville, KY
Nashville, TN

Letter of Transmittal

October 7, 2010

To:	Mr. Tom Boone Plumbing Plan Consultant 2332 Royal Drive Ft. Mitchell, KY 41017	From:	Mr. Allen Tucker GRW Engineers, Inc. 859-223-3999 atucker@grwinc.com

Project: **GRW #3789**
Northern Kentucky Water District
Taylor Mill Treatment Plant

Attached are:

- ☐ Shop Drawings
- ☒ Letter
- ☐ Prints
- ☐ Change Order
- ☒ Plans
- ☒ Specifications
- ☐ Samples
- ☐ CD
- ☐ Invoice

Remarks: Accompanying this cover letter is a plan submission application for the Northern KY Water Dist. Taylor Mill Treatment Plant project for your approval.

Included: Plan Application Form; $25.00 review fee; Plumbing Specifications;

One complete set of drawings;3 sets of plumbing drawings

- ☒ For Approval
- ☐ For Review
- ☐ Returned for Correction
- ☐ For Your Information
- ☐ For Your Records
- ☐ Test Sample as Noted
- ☐ As Requested
- ☐ Approved as Noted

PLAN APPLICATION FORM
COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HOUSING, BUILDINGS AND CONSTRUCTION
DIVISION OF BUILDING CODE ENFORCEMENT & DIVISION OF PLUMBING
101 SEA HERO ROAD, SUITE 100
FRANKFORT, KENTUCKY 40601-5405
BUILDING CODES: 502/ 573-0373 PLUMBING: 502/ 573-0397

NOTE: Complete all applicable spaces **Please type or print** Today's Date: 10-07-2010
REV.6/2008

NAME OF PERSON SUBMITTING PLANS: Allen Tucker PHONE (859) 223-3999 IS THE BCE PLAN REVIEW FEE INCLUDED WITH PLANS? (circle one) YES NO - Plumbing Review Fee
MAILING ADDRESS: 801 Corporate Drive | Lexington | KY | 40503
NUMBER / STREET, HWY, ROAD or P O BOX | CITY | STATE | ZIP CODE

BUSINESS & PROJECT NAME: (Or tenant name if multi-tenant building) NKWD - Taylor Mill Water Treatment Plant Advanced Treatment Improvements
PROJECT LOCATION: 608 Grand Ave | Taylor Mill | 41015 | Kenton
NO / STREET, HWY or ROAD (Please do not indicate P.O. Box or Postal Routes) | CITY | ZIP CODE | COUNTY

OWNER (INDIVIDUAL & COMPANY): ______ PHONE ( ) ______
MAILING ADDRESS: ______
NUMBER / STREET, HWY, ROAD or P O. BOX | CITY | STATE | ZIP CODE

ARCHITECT (NAME & FIRM) ______ PHONE ( ) ______
I, AS THE ARCHITECT LISTED ABOVE, AM RESPONSIBLE FOR CONSTRUCTION CONTRACT ADMINISTRATION. ☐ YES ☐ NO
MAILING ADDRESS: ______
NUMBER / STREET, HWY, ROAD or P. O BOX | CITY | STATE | ZIP CODE

ENGINEER (NAME & FIRM) Allen Tucker GRW PHONE (859) 223-3999
MAILING ADDRESS: 801 Corporate Drive | Lexington | KY | 40503
NUMBER / STREET, HWY, ROAD or P O BOX | CITY | STATE | ZIP CODE

PROJECT CONTRACTOR: ______ PHONE ( ) ______
MAILING ADDRESS: ______
NUMBER / STREET, HWY, ROAD or P. O. BOX | CITY | STATE | ZIP CODE

BUILDING INFORMATION

NUMBER OF BUILDINGS IN THIS SUBMITTAL: ______ USE OF BUILDING(S) ie...restaurant, office, classroom, storage or other (please specify) Water Treatment Plant

BUILDING(S) IN THIS PROJECT IS / ARE: ☐ NEW FREESTANDING BUILDING ☐ NEW ADDITION TO EXISTING STRUCTURE ☐ RENOVATION ONLY ☑ RENOVATION & ADDITION
TOTAL AREA IN NEW BLDG. OR ADDITION: ______ FT² NUMBER OF LEVELS (INCLUDING BASEMENT) ______ BASEMENT ☐ YES ☐ NO
TOTAL AREA IN EXISTING BLDG.: ______ FT² DATE CONSTRUCTION TO BEGIN: ______ ESTIMATED COMPLETION DATE: ______

TYPE OF PLAN SUBMITTALS

BUILDING PLAN SUBMITTALS (Check the type of evaluations requested at this time)		SHOP DRAWING PLAN SUBMITTALS (Check the type of evaluations requested at this time)	
BUILDING PLAN REVIEW (BCE)	**PLUMBING PLAN REVIEW**		
Full Building Review ☐	Plumbing Review ONLY ☑	Suppression System (Sprinkler, CO2, Etc.) ☐	Range Hood System ☐
Expedited Site & Foundation Review ☐	Water Supply Review ☐	Alarm Systems ☐	Fuel Tank ☐
Partial Evaluation (please specify) ☐	Waste Water Review ☐	Boiler System ☐	Elevator ☐
	Other (please specify) ☐	Bleacher Seating ☐	Swimming Pool ☐
			Prefabricated Truss ☐
SUBMIT ONLY ONE SET FOR BCE	*SEE BACK OF THIS FORM FOR PLUMBING PLAN SET REQUIREMENTS*	*SUBMIT ONLY ONE SET OF PLANS FOR THE ABOVE*	

THE INFORMATION IN THIS SECTION IS FOR THE DIVISION OF PLUMBING (TO BE COMPLETED BY PERSON SUBMITTING PLANS)

DESIGN CAPACITY OF BUILDING: NO. OF MALES 1 NO. OF FEMALES 1 ARE RESTROOMS ACCESSIBLE TO PUBLIC? ☐ YES ☑ NO
SEWAGE DISPOSAL: TYPE: ☑ MUNICIPAL ☐ PRIVATE ARE RESTROOMS ACCESSIBLE TO DISABLED? ☑ YES ☐ NO
WATER SUPPLY: ☑ PUBLIC ☐ DRILLED WELL ☐ CISTERN ☐ HAULED WATER ☐ ROOF WATER ☐ SPRING ☐ STREAM
IF PRIVATE, INDICATE THE TYPE AND THE DESIGN ______
BY WHOM: A. Allen Tucker | Mech Engr | 20828
NAME | TITLE | REGISTRATION NUMBER

THIS SECTION TO BE COMPLETED BY THE LOCAL HEALTH DEPARTMENT OFFICIAL (Must be completed prior to sending Plumbing Plans to Frankfort)

REVIEWED BY: ______
NAME
______ DATE ______
TITLE
APPROVED BY:
COUNTY OR DISTRICT
HEALTH DEPARTMENT: ______

THIS AREA FOR DEPARTMENT USE ONLY

EXHIBIT 9B
DOCUMENTATION FOR
MISCELLANEOUS COSTS AND CONTINGENCIES
(REFERENCE REVISED EXHIBIT D TO APPLICATION)

Amy Kramer

From: Bari Joslyn
Sent: Friday, January 29, 2010 1:10 PM
To: Richard Harrison; Ron Lovan
Cc: Amy Kramer; Jim Dierig
Subject: houses on Grand Avenue

Ron:

As you requested at the management meeting, we have looked into 2 things regarding the houses adjoining the TMTP.

1. Contact a house mover – Jim met N KY House Movers, Raising and Rigging at the houses on Thursday. Their estimator, Finis, gave us an estimate of $58,000 to move them within a 3 – 5 mile range. He does not recommend moving them more than 3 – 5 miles because of their condition. The estimate includes average costs to move electric, phone, and cable lines since the one house is tall. Finis said those costs could be more. He also asked if we'd gotten a price to tear them down yet and Jim said "yes, about $13,000". Candidly, Finis looked in the windows and told Jim he thought we should tear them down. Of course, that's just his opinion and he doesn't know about our desire to contact a charity.
2. Call Habitat for Humanity to see if they would want the houses - Related to whether or not to tear them down, we have left 3 messages for Habitat for Humanity, the last one for the woman who is in charge of construction. We have not heard anything back yet but I will let you know as soon as we do.

We will keep you posted.

Bari L. Joslyn
Vice President, Water Quality and Production
Northern Kentucky Water District
700 Alexandria Pike
Fort Thomas, KY 41075
859 547 3272

Amy Kramer

From: Bari Joslyn

Sent: Tuesday, January 26, 2010 10:52 AM

To: Amy Kramer

Subject: RE: Grand Avenue Properties

Amy, I will bring it up tomorrow and see if we can get the ok to proceed. Would you mind briefing Richard just so he'll have the same information in case Ron looks at me like I'm speaking a foreign language? ☺

Bari L. Joslyn
Vice President, Water Quality and Production
Northern Kentucky Water District
700 Alexandria Pike
Fort Thomas, KY 41075
859 547 3272

-----Original Message-----
From: Amy Kramer
Sent: Tuesday, January 26, 2010 10:49 AM
To: Bari Joslyn
Subject: RE: Grand Avenue Properties

Bari,

It would be helpful to have them removed before surveying but we can accommodate them being there if necessary. We intend to proceed with the surveying within the next 3 weeks or so. For the purposes proceeding with design we are assuming that the houses will be demolished before start of construction. This is the critical decision to confirm with Ron – that they will be gone by the end of this year. Otherwise the proposed concept will not work.

Amy

From: Bari Joslyn
Sent: Tuesday, January 26, 2010 10:40 AM
To: Amy Kramer
Subject: RE: Grand Avenue Properties

Hi Amy:

We took quotes for demolishing the houses with Vince Kahmann (Mary Carol's Dad) being the lowest (about $12,000 for both). We had selected Vince, along with 2 other contractors that were on distribution's list. Ron didn't want us to use Mary Carol's Dad so said we would have to do a formal bid. Before that, he wanted us to investigate burning the houses which the Taylor Mill Fire Department said "no" to. He also wanted us to investigate moving the houses because he thought a charity might want them. We have been unable to find a house moving company but have spoken with Building Crafts who said that 1) houses that are moved are more frequently frame than brick and 2) his ball park estimate was $300K. I reported all of this to Ron but have not received any answer from him.

I could approach him again if you'd like, or if you guys think you'd have more luck, we'd be happy to turn this over to somebody else! ☺ At a minimum, I could bring it up at the staff meeting and see if we can get him to provide some direction.

Bari L. Joslyn
Vice President, Water Quality and Production
Northern Kentucky Water District
700 Alexandria Pike
Fort Thomas, KY 41075
859 547 3272

-----Original Message-----
From: Amy Kramer
Sent: Tuesday, January 26, 2010 10:35 AM
To: Bari Joslyn
Subject: Grand Avenue Properties

Bari,

What is the status of demolishing the houses on Grand Avenue? Ideally they should be removed before doing the fieldwork to survey etc.

Thanks, Amy

Amy Kramer

From: Bari Joslyn

Sent: Thursday, March 04, 2010 11:19 AM

To: Ron Lovan

Cc: Amy Kramer; Jim Dierig

Subject: Grand Ave houses

Ron, I just wanted to let you know that the contractor will be on site Monday to start demolishing the houses next to our TMTP. We talked with the neighbors yesterday and they said they appreciated us giving them notice. I also called Jill Bailey who said the same. We expect this work to be finished within 1 week. I will let you know if we get any calls from anyone else.

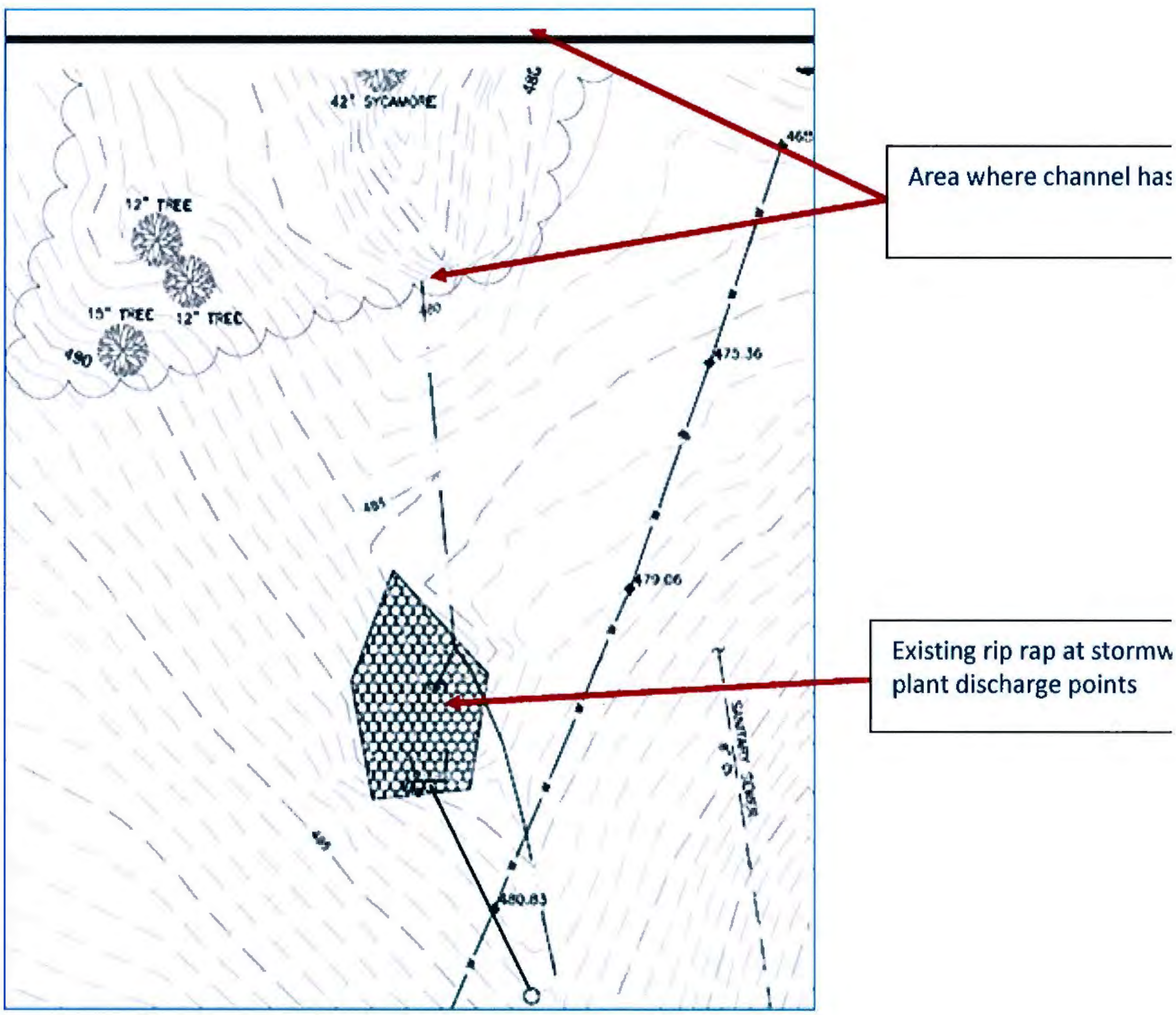
Amy Kramer

From: Abbott, Jason [JAbbott@PIRNIE.COM]
Sent: Wednesday, July 14, 2010 2:40 PM
To: Amy Kramer
Subject: RE: Follow-up Items from TMTP Meeting
Attachments: Picture 059.jpg; Picture 058.jpg

Amy,

I just left you a voicemail. One item that I forgot to bring up at yesterday's meeting is as follows:

1. In Thelen's final geotechnical report they are planning to recommend that the channel that leads from the existing overflow and stormwater discharge area (currently protected with rip rap) to Banklick Creek be fixed. Currently the discharge from the existing stormsewer and plant discharge has eroded this channel to approximately a 6 foot deep cut in the hill, which is undermining trees along Banklick Creek (please see attached photos).



Please give me a call to discuss.

Thanks,
Jason

Jason M. Abbott, P.E. | Project Engineer | Malcolm Pirnie, Inc. | 8600 Governor's Hill Dr, Sute 210 | Cincinnati, OH 45249 | Phone: 513-677-6861 | Fax: 513-677-8480 | jabbott@pirnie.com

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From: Amy Kramer [mailto:AKramer@nkywater.org]
Sent: Wednesday, July 14, 2010 1:59 PM
To: Bari Joslyn; Richard Harrison
Cc: Abbott, Jason
Subject: RE: Follow-up Items from TMTP Meeting

Bari and Richard,

I thought of one more item. I am planning to call the church (but am holding off for now) to find out their school sessions for 2011 – 2013 so that we can require certain portions of the work during summer break (or other extended breaks). The Howard Ave entrance and parking lot will be affected during construction (Pirnie indicated they would help us understand duration and nature of impact). Jason said someone from the church was asking questions about how long we would be there the one day we dug up the raw water main in Howard back in April – and we contacted the church in advance to notify them and intentionally scheduled the work during spring break. Clearly they value this access, and we will need to communicate with them at some point. We need a plan on when and who will handle church relations and communications. Please let me know your thoughts. I assume this is an area where Ron will want to provide direction.

Amy

From: Amy Kramer
Sent: Wednesday, July 14, 2010 1:48 PM
To: Bari Joslyn; Richard Harrison; Jim Dierig; Bill Wulfeck; Mary Carol Wagner
Cc: William Stewart; 'Abbott, Jason'
Subject: Follow-up Items from TMTP Meeting

Hi all,

There are a few items that we didn't cover in the meeting yesterday where I still need your input. Here they are:

1. Finish selections – Jimmy wants to have a face-to-face meeting at TMTP to pick brick colors, etc. He will be contacting me to schedule this meeting with our staff. Who gets to be the lucky decision makers for this meeting?

2. Salvage Items - Please determine what equipment if any we want salvaged and turned over to us following demolition? For example, do we want the floc drives? Anything we don't request to be salvaged will be removed from the site by the contractor. I assume this is in Jim's area to determine.

3. Access Control and Security - William will be taking the lead in marking up a drawing or creating a table for security and access control. The info should be sent to me, and I'll forward to Pirnie. Note that Bill has asked that doors 104A and 107B serve as access control from the truck bay to the new admin/lab area to restrict movement of the truck drivers.

4. Restrooms - Will the new restrooms be unisex? Optionally I assume the one accessible from the truck bay would be men's and the "clean" one in the admin area would be women's (except the mop sink is in the

clean one). Bari can you answer this one?

5. Mop Sink - The mop sink ended up in the "clean" restroom – I assume because the available space is bigger. Is this okay here or should we see about moving the sink elsewhere? Bari can you take lead on this?

6. Generator Enclosure - Jim will prepare our thoughts on an enclosure for the generators in preparation of a conference call with CDP. Michelle will contact me to schedule the meeting. We had this statement in the agreement scope "An enclosure may be desired to enhance the aesthetics" so either style can be accommodated in the design.

7. Level Transmitter - Design team will contact William to discuss comment #57 regarding radar vs. sonar level transmitters.

8. Fencing – We need to determine the style(s) of fence to be used. Bari can you please let me know the decision, and I will forward to Pirnie.

9. Testhole for new 36" main – Distribution crew will be digging a testhole to confirm depth at crossing with 24" raw water, 24" supply, and 24" GAC/UV treated (too much rock used as backfill to make Badger equipment practical). I assume one excavation in the general area of these crossings will suffice. I will take measurement from ground to top of pipe. Jason - Let me know if anyone from the design team needs to be there.

I think that's it! Please try to respond or setup meeting as appropriate so that we can resolved these items by the end of this month. Let me know if you have any questions.

Thanks, Amy

Amy Kramer

From: Carter Dickerson [CDickerson@VioxInc.com]
Sent: Wednesday, September 01, 2010 11:39 AM
To: Amy Kramer
Subject: RE: TMTP Detention Basin

Amy,

Yes, it would pretty much be the same level of effort for either the new open channel design or restoring the existing channel. The proposal will allow for the flexibility of the design direction. I will not include a design fee for the piping option. We are definitely thinking that the piping option is not very desirable.

Thanks for the clarifications, I will have this over to you soon.

Carter P. Dickerson, RLA, ASLA
Landscape Architect

Viox & Viox, Inc.
466 Erlanger Road
Erlanger, KY 41018
859-727-3293
www.vioxinc.com

Creating innovative pathways through progressive design... one client at a time.
~Since 1945~

From: Amy Kramer [mailto:AKramer@nkywater.org]
Sent: Wednesday, September 01, 2010 11:23 AM
To: Carter Dickerson
Subject: RE: TMTP Detention Basin

Carter,

For your proposal, would the design of a new open channel vs. restoring the existing be about the same level of effort? It would be nice to have the flexibility to do either one with your proposal. The pipe option has advantages and disadvantages – haven't thought it through alot. For now I don't need a design fee from you on the pipe design, unless you would recommend it instead of an open channel – which it sounds like you don't.

Amy

From: Carter Dickerson [mailto:CDickerson@VioxInc.com]
Sent: Wednesday, September 01, 2010 10:06 AM
To: Amy Kramer
Subject: RE: TMTP Detention Basin

Amy,

I am having Jim Viox review the proposal that I have put together so far, and I wanted to drop you a note to stay in touch. I also have a question about your comment for extending the pipe or relocating the channel. If that were the solution, would you want Viox & Viox to design that pipe extension or Malcolm Pirnie? It seems like it would be best and most efficient for Malcolm Pirnie to do that if that is the plan. Of course we can still do that design if you would like, or if our price may be more suitable, but I do not necessarily think that solution is the best option. I like the idea of possibly building a new open channel and taking the burden off of the eroded channel that exists, but I'm not exactly sure that would be cheaper. If that were the plan, I assume NKWD would still want to remedy the severe erosion that exists, then we would design the new open channel with sufficient devices to help prevent that deep erosion from becoming a future problem?

Thanks for your input and the extra time to finish this proposal for you.

Carter P. Dickerson, RLA, ASLA
Landscape Architect

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From: Amy Kramer [mailto:AKramer@nkywater.org]
Sent: Tuesday, August 24, 2010 4:15 PM
To: Carter Dickerson
Subject: RE: TMTP Detention Basin

Carter,

I met Malcolm Pirnie out there last week. They suggested we consider extending the pipe further down the hillside or building a new open channel to the east a little bit – between the existing outfall channel and the 36" water main. They thought restoring the channel in its current location would be the most expensive option. I just wanted to share this in case you want to consider it in your proposal.

Amy

From: Carter Dickerson [mailto:CDickerson@VioxInc.com]
Sent: Tuesday, August 24, 2010 3:48 PM
To: Amy Kramer
Subject: RE: TMTP Detention Basin

Thank you, Amy.

This helps us determine some final information needed for the proposal.

I will have it ready for you sometime this week.

Carter P. Dickerson, RLA, ASLA
Landscape Architect

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From: Amy Kramer [mailto:AKramer@nkywater.org]
Sent: Tuesday, August 24, 2010 9:04 AM
To: Carter Dickerson
Subject: FW: TMTP Detention Basin

Carter,

Here is the dwg file of the drawing.

Thanks, Amy

From: Abbott, Jason [mailto:JAbbott@PIRNIE.COM]
Sent: Monday, August 23, 2010 3:34 PM
To: Amy Kramer
Subject: RE: TMTP Detention Basin

Amy,

Please see the attached storm sewer drawing C-02-312. Please let me know if you have any issues opening this drawing. It was saved in Civil 3D 2007.

Sincerely,
Jason

Jason M. Abbott, P.E. | Project Engineer | Malcolm Pirnie, Inc. | 8600 Governor's Hill Dr, Sute 210 | Cincinnati, OH 45249 | Phone: 513-677-6861 | Fax: 513-677-8480 | jabbott@pirnie.com

---

From: Amy Kramer [mailto:AKramer@nkywater.org]
Sent: Tuesday, August 17, 2010 9:40 AM
To: Abbott, Jason
Subject: RE: TMTP Detention Basin

Jason,

Could I please get this drawing as a dwg file?

Thanks, Amy

From: Abbott, Jason [mailto:JAbbott@PIRNIE.COM]
Sent: Friday, August 13, 2010 4:23 PM
To: Amy Kramer
Subject: TMTP Detention Basin

Please see attached

Jason M. Abbott, P.E. | Project Engineer | Malcolm Pirnie, Inc. | 8600 Governor's Hill Dr, Sute 210 | Cincinnati, OH 45249 | Phone: 513-677-6861 | Fax: 513-677-8480 | jabbott@pirnie.com

Amy Kramer

From: Carter Dickerson [CDickerson@VioxInc.com]
Sent: Tuesday, September 28, 2010 12:17 PM
To: Amy Kramer
Subject: RE: Draft Agreement - TMTP Erosion Repair

Amy,

Thank you for sending over the agreement. I will need to add a short amount of time to cover the 3 site visits, as I was trying to be very economical with our proposal. Basically, it comes to an added $420.00 for the estimated time needed to make 3 thorough site inspections during construction.

Please let me know how to proceed or if this email notice enough to revise the agreement and get everything moving forward.

Thanks,

Carter

Carter P. Dickerson, RLA, ASLA
Landscape Architect

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From: Amy Kramer [mailto:AKramer@nkywater.org]
Sent: Monday, September 27, 2010 3:06 PM
To: Carter Dickerson
Subject: Draft Agreement - TMTP Erosion Repair

Carter,

Please review the draft agreement for design and overseeing the repair of the erosion at TMTP. I wanted to make sure you were aware that I added a provision for conducting up to 3 site visits during construction to review the contractor's work. I apologize as this was overlooked in the RFP that I sent you. Please let me know if this impacts your proposed fee.

Thanks, Amy

Amy Kramer

From: Carter Dickerson [CDickerson@Viox Inc.com]

Sent: Monday, October 04, 2010 11:01 AM

To: Amy Kramer

Subject: RE: Draft Agreement - TMTP Erosion Repair

Amy,

We have reviewed the agreement and scope and I have a couple of questions. The payment portion of the agreement does not look like the billing rates that we usually apply toward our projects. There isn't a billing rate for Landscape Architect, and I wasn't sure if we needed to add that, or if that page was just standard and isn't as critical so long as the final billed amount is the contract price. Also, the surveying scope seems like a little bit of boiler plate, at least concerning the rights of way locations. Didn't you tell me earlier that you could provide us the property lines, bearings and distances, from the previous survey?

Those were really the only two things that stood out.

As far as a schedule is concerned, I think that summer is the optimum time for performing this work, as the creek level should be down to its lowest water level of the year. We could topo, survey environmental aspects and design over the winter. The environmental assessment could actually happen immediately, in case any special permitting/allowances are found as necessary. No trees are allowed to be taken down, if a bat habitat is found, over the summer months, but we do not anticipate removal of any trees anyway. A spring bidding would set it up nicely for summer construction, which could be staked as needed and completed relatively quickly...

Please let me know if this is satisfactory and if the additional $420.00 for the added construction site visits is acceptable.

Thanks,

Carter

Carter P. Dickerson, RLA, ASLA

Landscape Architect

Viox & Viox, Inc.

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Erlanger, KY 41018

859-727-3293

www.vioxinc.com

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~Since 1945~

From: Amy Kramer [mailto:AKramer@nkywater.org]
Sent: Tuesday, September 28, 2010 12:49 PM
To: Carter Dickerson

Subject: RE: Draft Agreement - TMTP Erosion Repair

Carter,

I don't have a schedule in mind – there isn't anything driving it on our end. Can you suggest a design, bid, and construction timeline that makes sense based on optimal times for doing the construction work? I'm sure there are times that are better than others for doing this work based on Banklick Creek and habitat. Once I have this information, we can determine when we'll need to start design.

Other than that, does the agreement and scope look acceptable? I will need to get internal approval from Ron Lovan. Once it gets signed by Ron, then I will send to you to get it signed.

Amy

From: Carter Dickerson [mailto:CDickerson@VioxInc.com]
Sent: Tuesday, September 28, 2010 12:17 PM
To: Amy Kramer
Subject: RE: Draft Agreement - TMTP Erosion Repair

Amy,

Thank you for sending over the agreement. I will need to add a short amount of time to cover the 3 site visits, as I was trying to be very economical with our proposal. Basically, it comes to an added $420.00 for the estimated time needed to make 3 thorough site inspections during construction.

Please let me know how to proceed or if this email notice enough to revise the agreement and get everything moving forward.

Thanks,

Carter

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From: Amy Kramer [mailto:AKramer@nkywater.org]
Sent: Monday, September 27, 2010 3:06 PM
To: Carter Dickerson
Subject: Draft Agreement - TMTP Erosion Repair

Carter,

Please review the draft agreement for design and overseeing the repair of the erosion at TMTP. I wanted to make sure you were aware that I added a provision for conducting up to 3 site visits during construction to review the contractor's work. I apologize as this was overlooked in the RFP that I sent you. Please let me know if this impacts your proposed fee.

Thanks, Amy

Amy Kramer

From: Jim Dierig
Sent: Wednesday, February 02, 2011 1:00 PM
To: Amy Kramer
Cc: Dave Enzweiler; Richard Harrison
Subject: Grand Ave. house

Hey Amy, we have the following items on file related to the demo of the houses on Grand Ave.

- Demolition permits from the NKAPC for both houses.
- Application for Determination and Review Project of Area-Wide Significant and the NKAPC response (approval).
- NKAPC Statement of Action related to some of their suggestions. These were discussed during the preliminary design with GRW/Pirnie.
- EPA permit related to the Renovation/Demolition Notification Requirements.
- An EPA document stating we did not violate any Air Quality standards related to the demolition.
- SD1 sewer lateral abandonment application and permit.
- Asbestos report submitted by WesTech and all abatement and removal of necessary materials.

Thanks,

Jim

Amy Kramer

From: Kyle Ryan
Sent: Tuesday, March 15, 2011 2:05 PM
To: Amy Kramer
Subject: Taylor Mill Erosion Repair Project

Amy,

After walking the Taylor Mill Erosion Repair project with Carter Dickerson and Lee Otte, it was determined that two trees which need to be taken down as part of the project are "potential Indiana Bat habitat". Lee filed the necessary paperwork with U.S. Fish and Wildlife Service and we now have permission to clear the trees just as long as we do so by March 31st. I plan on marking the two trees with an "X" this afternoon and Ed said he would send a crew out to cut them down in the next few days. Once the trees are on the ground, Bob Buhrlage said the inmate help could clean up the fallen trees.

If you have any questions or concerns, please let me know.

Thanks,

Kyle

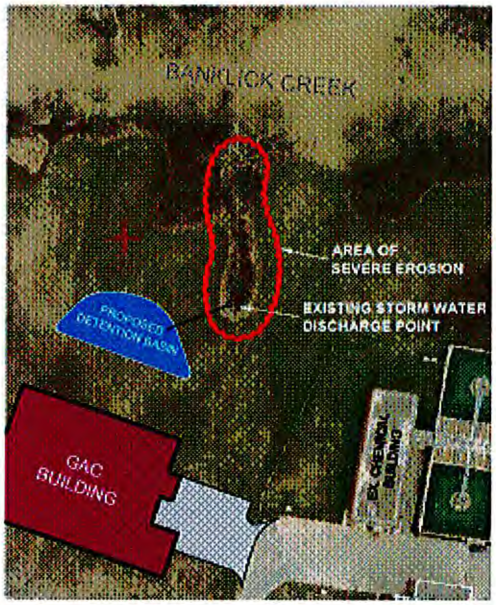
From: Dave Enzweiler
Sent: Monday, March 14, 2011 1:30 PM
To: Kyle Ryan
Cc: Kevin Owen; Jim Dierig
Subject: RE: Taylor Mill Erosion Repair Project

Have at it, looks like you have it all under control

From: Kyle Ryan
Sent: Monday, March 14, 2011 1:28 PM
To: Dave Enzweiler
Subject: Taylor Mill Erosion Repair Project

Dave,

Amy and I are working on a project to address erosion problems at the Taylor Mill Plant where we discharge storm water & process water into Banklick Creek. You are probably familiar with the area I am referring to but it is outside the fenced in area north west of the chemical building.



As part of the project, we will need to clear two trees which are classified as "potential Indiana bat habitat". We have permission from the US Fish and Wildlife Service to clear these two trees just as long as they are cut down before March 31st. John Scheben suggested that one of the distribution crews could cut down the two trees but thought I should ask you first incase you or someone else from the plants wanted to handle it.

So if you can, please let me know how you would like us to proceed as far as cutting down the two trees. If you have any questions please let me know.

Thanks,

Kyle Ryan

Amy Kramer

From: Abbott, Jason [Jason.Abbott@arcadis-us.com]

Sent: Tuesday, April 05, 2011 5:15 PM

To: Amy Kramer

Subject: TMTP Computer & Software Allowance

Amy,

The breakdown of the Computer Hardware / Software Allowance is as follows:

2 PCs + monitors: $5000/ea
2 SCADA software: $8000/ea
1 UPS: $1000/ea
30% contingency
Total: $35,000

Sincerely,
Jason

Jason Abbott | Project Engineer | Jason.Abbott@arcadis-us.com
Malcolm Pirnie, the Water Division of ARCADIS | 8600 Governor's Hill Drive, Suite 210 | Cincinnati, OH 45249-1388
T. 513.677.6861 | F. 513.677.8480
www.arcadis-us.com
ARCADIS, Imagine the result

Amy Kramer

From: Amy Kramer
Sent: Friday, July 01, 2011 2:02 PM
To: Richard Harrison
Subject: TMTP Permit

Richard,

The NKAPC approved the TMTP AT project in March. There are 5 separate permits that are written but are being held until the following is provided:

- contract name, phone, fax
- copy of contractor insurance certificate
- occupational license by contractor for City of Taylor Mill
- payment of $5,165.44 for inspection fees

If we don't get started by about September 10, 2011 we will need to request an extension.

Thanks, Amy

p.s. don't forget the erosion repair project is waiting to be awarded – pending getting the permits

Blood Hound, Inc.

750 Patricks Place, Suite B
Brownsburg, IN 46112

Estimate

Date	Estimate #
5/26/2009	**3961**

Name / Address
Northern Kentucky Water District 2835 Crescent Springs Road Erlanger, KY 41018 Attn: Jeff Schuchter

Item	Description	Qty	Cost	Total
	602 GRAND AVE, TAYLOR MILL, KY			
Private Locate-Cincinnati	Private Locate-Cincinnati (hourly rate, 1 hour minimum)	5	160.00	800.00
GPS Data Collection-Ci...	GPS Mapping (data collection in field, hourly rate)-Cincinnati	4	160.00	640.00
GPS Post-Processing-Ci...	GPS Post-Processing (hourly rate)-Cincinnati	4	120.00	480.00
	Utilize EM locating equipment to locate underground piping on site, outlined in provided maps. Collect GPS locations of marked utilities on site, and provide customer with CAD drawing (NAD 1983 feet Kentucky State Plain West, DWG format) upon completion (add our collected data to customer's existing CAD file).			
	CONTACT PERSON: Jeff Schuchter at 859-426-2703 OR jschuchter@nkywater.org			
	SCHEDULED DATE: Tues 05/26/09 at 8:00am & Thurs 05/28/09 at 8:00am			
	PRICE MAY VARY (DOWN OR UP) BASED ON ACTUAL TIME ON SITE			

**Payment is due at the time of service, unless you already have an account with us. If you do have an account with us, payment terms are Net 30 days, unless otherwise stated in a pre-approved contract. To learn more, please call the office at 888-858-9830.
**PRICE MAY VARY BASED ON ACTUAL TIME ON SITE. The above pricing is based only on the information supplied by the customer. If a site walkthrough has not been conducted, this may affect the price.
WE LOOK FORWARD TO WORKING WITH YOU!

Total **$1,920.00**

Phone #	Fax #	E-mail	Web Site
888-858-9830	888-858-9829	BHI@bhug.com	www.bhug.com

Taylor Mill Treatment Plant Advanced Treatment Improvements

Site Planning Meeting

August 11, 2009

Meeting Goal

Select the best site alternative for the PTB and GAC buildings

Since We Last Met…

- Additional alternatives were developed
- Site sketches were created
- Thelen was consulted
- Differential costs were prepared
- Advantages and disadvantages were summarized

Important Items to Keep in Mind

- The PTB is being relocated due to risk associated with the construction schedule and permissible length of 50% capacity reduction.
- The generators will be located in the area currently occupied by the North Sed Basin.
- No estimate is available for the generator project, but it is anticipated that the proposed location is the best for the District from an operations, maintenance and cost perspective.
- The District does not want carbon trucks to interfere with chemical unloading.

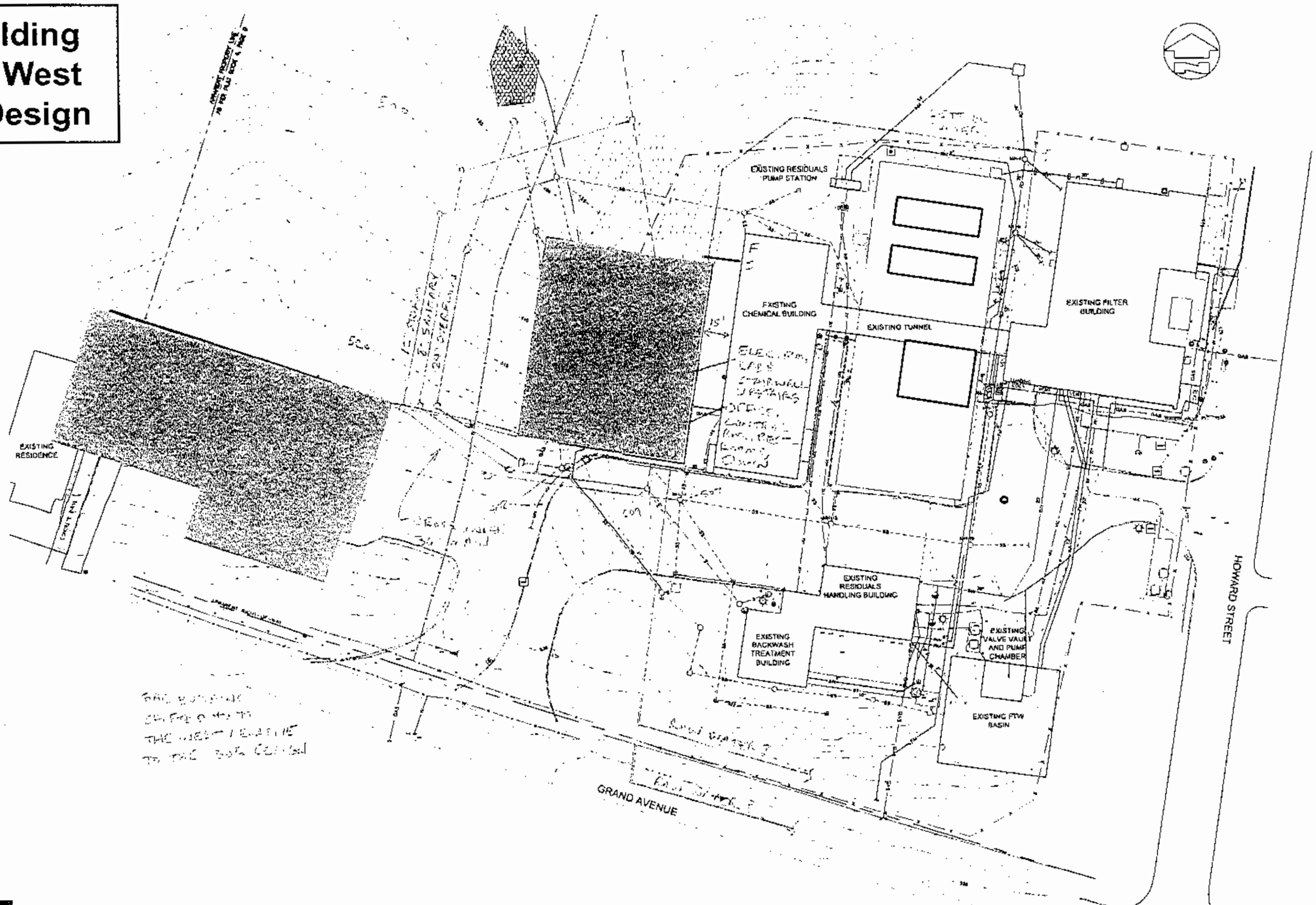
Additional Cost Items

- A new residuals pump station with positive displacement pumps will be recommended for all alternatives due to the sedimentation process change which will result in thicker solids, especially after weekend shutdowns during high turbidity periods.
- Foundation costs specific to site locations and rock depths.
- Raw water line relocation.
- Utility relocation requirements.
- Shoring costs.

Alternatives

Alternative 1

GAC Building ~40-ft to West of 30% Design



MALCOLM PIRNIE

Alternative 1

Advantages

- GAC Building moves only ~40-ft to West (low design change)
- PTB close to main plant/further from Grand
- Shorter process lines:
  - Chemical
  - Settled water
- More parking available
- Allows for separate GAC entrance or future drive-through
- PTB can be constructed while existing process in-service

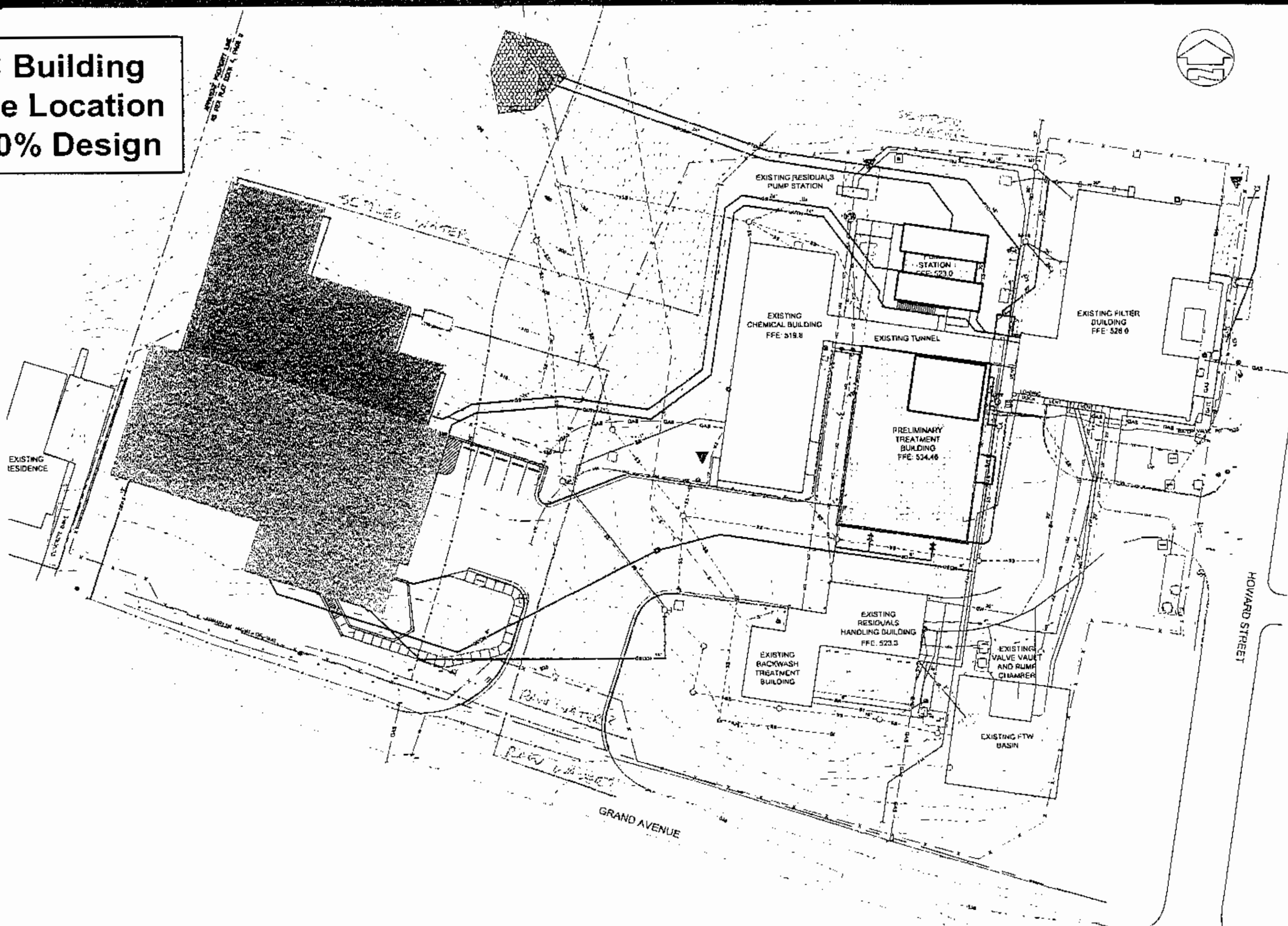
Alternative 1

Disadvantages

- Greatest amount of utility relocation
- Multiple crossings of the 36” WM required
- Greatest sq. ft. of water holding structure above grade (aesthetic issue)
- Constructability on steep slope
- Greater foundation considerations than 2, less than 3
- May require shallow shoring near Chemical Building

Alternative 2A

GAC Building
Same Location
as 30% Design



MALCOLM PIRNIE

Alternative 2A

Advantages

- GAC Building stays in designed location (Low design change)
- Shortest GAC piping of alternatives considered
- Lowest risk alternative
- Least disruption during construction
- PTB further from Grand Ave.
- Allows for either separate GAC entrance or future drive-through

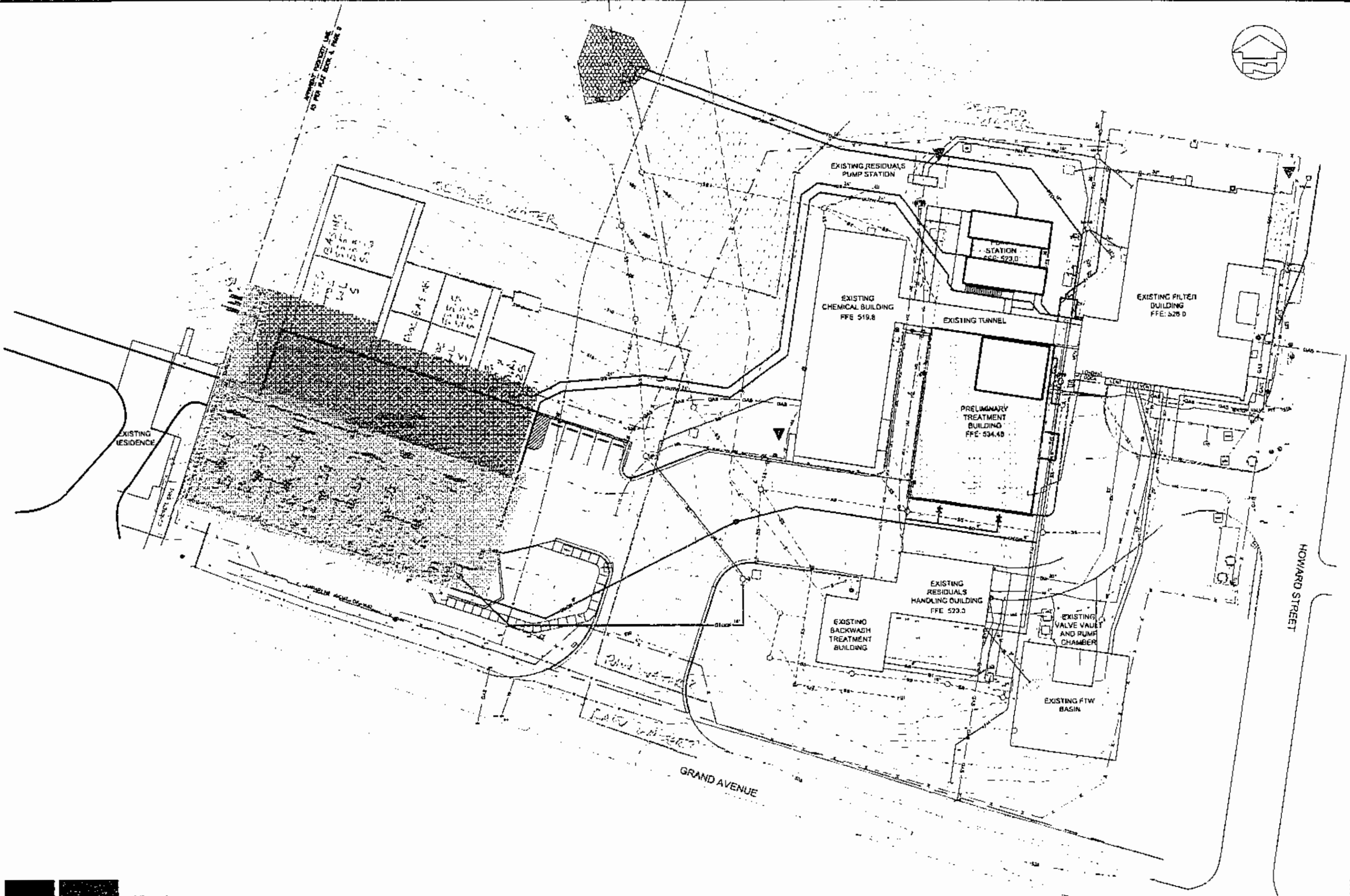
Alternative 2A

<u>Disadvantages</u>

- Limited vehicle access to PTB due to topography
- Vehicle access to PTB requires significant filling on slopes and requires retaining wall
- Longest PTB piping distances & further from operators

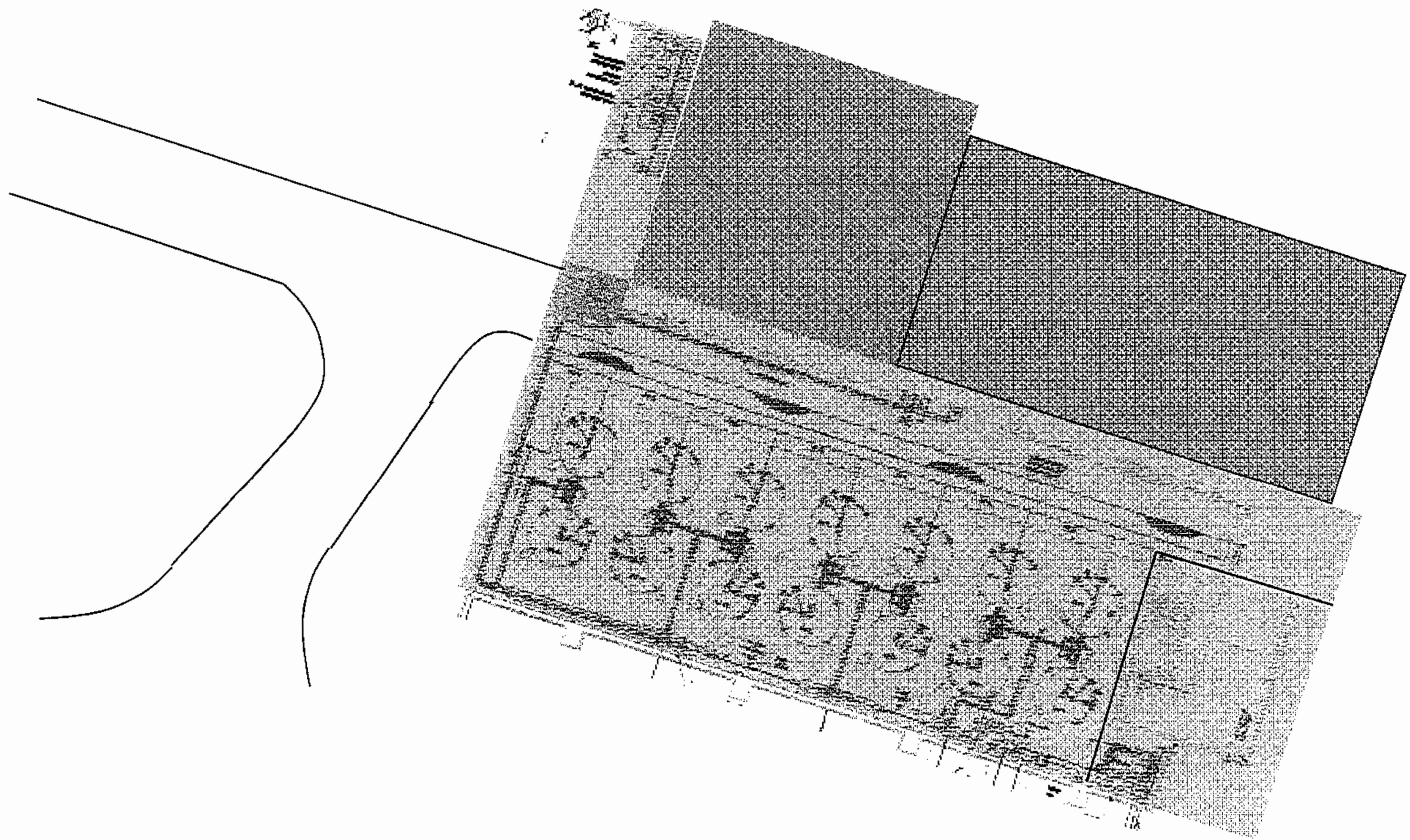
MALCOLM PIRNIE

Alternative 2B



MALCOLM PIRNIE

Alternative 2B



Alternative 2B

<u>Advantages</u>

- Lowest risk alternative
- Shared building costs
- Access to PTB from shared truck aisle
- Least disruption during construction
- Allows for either separate GAC entrance or future drive-through
- Reconstruction at main gate may not be required

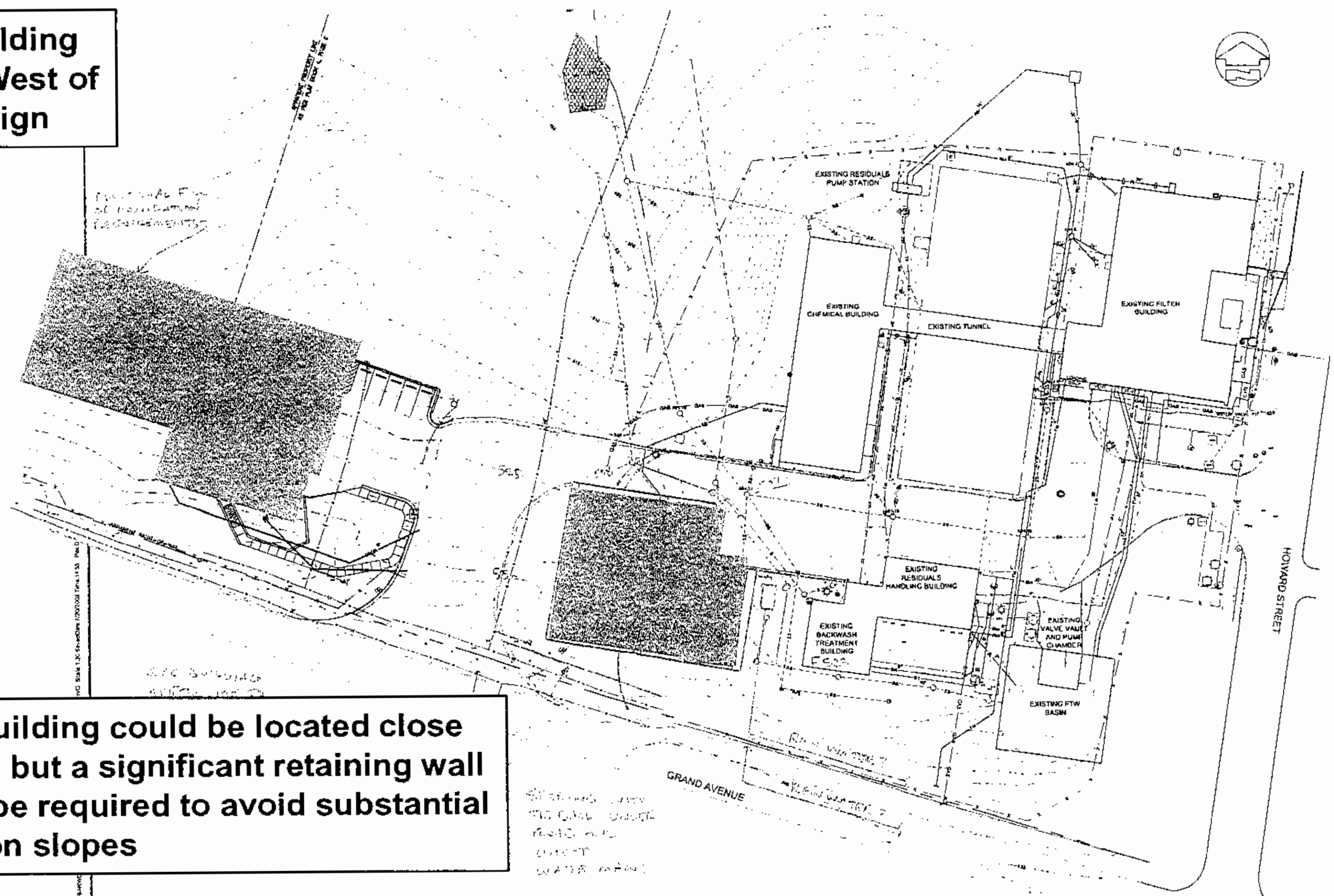
Alternative 2B

Disadvantages

- Longest PTB piping distances

Alternative 3

GAC Building ~100-ft West of 30% Design



GAC Building could be located close to PTB, but a significant retaining wall would be required to avoid substantial filling on slopes

MALCOLM PIRNIE

Alternative 3

Advantages

- PTB close to filter building (shorter PT piping)
- Shorter raw water main piping

Alternative 3

Disadvantages

- PTB very close to Grand Ave, visual impact to neighbors
- Requires major shoring with tiebacks under Grand Ave. and under major water mains
- GAC Building is ~100-ft west of 30% design location, increasing piping distances
- GAC Building increased foundation costs due to topography
- Significant relocation of existing known utilities required
- Separate GAC entrance or future drive-through likely not possible
- Deep pump room will be required
- Retaining wall for vehicle access

Alternative Specific Costs Comparison

Cost Description	Alternative 1 (West of Chemical Building)	Alternative 2A (North of GAC Building)	Alternative 2B (Combined PTB+GAC Building)	Alternative 3 (West of Backwash Treatment Building)
Foundations and Shoring	375,000	176,000	149,000	623,000
Residuals Pump Station	250,000	320,000	320,000	350,000
Process Piping	98,000	215,000	231,000	152,000
Utility/Piping Relocation	175,000	0	0	38,000
Site Access	72,000	314,000	65,000	23,000
TOTAL	**970,000**	**1,025,000**	**765,000**	**1,186,000**

Relative Cost Increases/Decreases

Increases

- Raw water main relocation
- Longer Settled water lines
- Removal of tunnel, new concept for chemical piping
- Additional pipe relocations
- Lab relocation
- New residuals pump station

Decreases

- Generator costs
- Piping to/from GAC Feed Pump Station
- Tunnel rehabilitation
- RISK

September 14, 2010

Northern Kentucky Water District
P.O. Box 18640
2835 Crescent Springs Road
Erlanger, KY 41018
Fax: 859 578-7893

ATTN: Amy Kramer

RE: Proposal for Engineering Services for the Taylor Mill Treatment Plant Banklick Creek Erosion Repair

Dear Ms. Kramer,

Thank you in advance for the opportunity to provide a proposal for services on the above referenced projects.

More specifically, the proposal includes the following tasks:

1) Preparation and submittal of a nationwide permit (NWP)
   Section 404 of the Clean Water Act (CWA) regulates the discharge of dredged, excavated, or fill material in wetlands, streams, rivers and other U.S. waters. The NWP is administered by the US Army Corps of Engineers (USACE) in Louisville. This proposal item assumes that the project meets the specific requirements for USACE NWP #13, which covers Bank Stabilization Activities.

2) Conduct a threatened and endangered species assessment

3) Field surveying of the proposed project area including producing a topographical survey and locations of all pertinent items in the project area.

4) Development of a preliminary engineering report, probable construction costs, detailed design of erosion repair and prevention plans, preparation of contract documents and detailed drawings, bid sheets, specifications, and a detailed final construction cost estimate.

5) Conduct public bidding of the project, including dissemination of the bid package to bidders, attending bid opening, preparation of bid tabulations, and written recommendation on award of contract.

6) Construction phase services, including attendance at pre-construction meetings, assistance with construction staking as necessary and consultation during construction.

Viox & Viox, Inc. can provide the engineering, submittals and bid services for a fee not to exceed $4,500.00 (Four Thousand Five Hundred Dollars).

Viox & Viox, Inc. can provide the threatened and endangered species survey and accompanying paperwork, our sub-consultant shall be Lee Otte with Otte Enterprises, for a fee not to exceed $2,200.00 (Two Thousand Two Hundred Dollars).

Viox & Viox, Inc. can provide the surveying services for a fee not to exceed &1,200.00 (One Thousand Two Hundred Dollars).

Viox & Viox, Inc. can provide the construction phase services, including staking, for a fee not to exceed $1,800.00 (One Thousand Eight Hundred Dollars).

Considering all of the individual amounts necessary to complete the project, the total project can be accomplished for a fee not to exceed $9,700.00 (Nine Thousand Seven Hundred Dollars).

If you have any questions, please call me.

Yours truly,

Carter P. Dickerson, RLA, ASLA

MALCOLM PIRNIE

Interoffice Correspondence

Date: October 6, 2009

To: Bari Joslyn, NKWD

Amy Kramer, P.E., NKWD

From: Christopher M. Weber, P.E., Pirnie

Jason M. Abbott, P.E., Pirnie

Brad Montgomery, P.E., GRW

Steve Vogelsberg, P.E., GRW

Re: Relative Cost Savings Associated with the Redesign of the Taylor Mill Treatment Plant Advanced Treatment Improvements Project

Introduction

The purpose of this memorandum is to identify cost savings associated with the changes required as a result of the following:

- Incorporation of the value engineering alternatives presented in the JJG Value Engineering Report, *First V.E. Study 30% Design Taylor Mill Water Treatment Advanced Treatment Improvements*, dated June 2009.
- Inclusion of the generator project and electrical improvements.
- Development of the site concept selected as part of task orders TMTP-SCP-02 and TMTP-SCP-03.

The VE report was completed to identify cost savings and improve the project; however the inclusion of the generator project and subsequent relocation of proposed buildings was required to properly site the generator and realize cost savings, as recommended in the VE report, associated with the footprint of the PTB. This is not to say that including the generator with the overall Taylor Mill Treatment Plant Advanced Improvements Project does not afford additional project/construction savings. Locating the generator in the footprint of the existing south floc/sed basin is the most cost effective location and reduces the size of the conductors, eliminates the need to move the 36" high pressure main and reduces additional site work or potential retaining walls and fill along the North West slope.

Estimate of Relative Cost Savings

The following items were identified as resulting in an overall savings to the project.

1. **VE 2.01 Use Four Stage Flexible Flocculation Design**
    a. This option will work if the PTB is relocated (moved from the footprint of the existing south floc/sed basin) and should reduce the construction and O&M cost as identified in the VE report and subsequent memos.

    Estimated Savings: Approximately $276,858

2. **VE 2.02 Design for Detention Time of 30 Minutes at Max Flow**
    a. This option will also work if the PTB is relocated (moved from the footprint of the existing south floc/sed basin) and should reduce the construction cost as identified in the VE report and subsequent memos.

    Estimated Savings: Approximately $206,000

3. **VE 3.03 Reconfigure Sedimentation Basins for a Thickener Style Sludge Collector in Lieu of Chain and Flight Collectors**
    a. Incorporate the VE recommendation of a circular mechanical mechanism to remove sludge and the reduced influent zone, to limit the footprint of the sedimentation basins ($77,000), and then reduce the VE recommended depth to realize further construction cost savings ($100,000).

    Estimated Savings: Approximately $177,000

4. **VE 28.01 Relocate Preliminary Treatment to Alternate Location on Site**
    a. Relocating the PTB is required to allow for many of the VE options as well as locating the generator at the TMTP. Locating the generator within the footprint of the existing south floc/sed basins is one the most cost efficient locations for the generators, due to the cost of the conductors that must be installed to the switch gear located in the existing filter building. The savings associated with moving the PTB are realized within other items in this memo.

    Estimated Savings: See Items Throughout this Memo

5. **Including Generator project with the TMTP Advanced Treatment Project**
    a. By combining the detailed design, bid phase services, construction administration and contracting of these projects it is anticipated that the District will realize a cost savings. These savings will come in the form of the following items:
        i. Economy of scale for a large project ($300,000)
        ii. Locate generator with GAC Feed PS near existing filter building for electrical feed to/from Filter Building ($30,000)
        iii. Single set of Contract Documents ($19,000)
        iv. Single advertisement & bidding process ($18,000)
        v. Single pre-bid meeting & bid opening ($2,000)
        vi. Eliminate second set of bonding and insurance ($15,000)
        vii. Single mobilization ($15,000)
        viii. Increased efficiency of one contractor on site ($60,000)
        ix. Eliminate second construction office & lay down area ($15,000)
        x. Single Contract to administer ($20,000)
            1. Both from a Consultant/project (CA) standpoint and a District administration standpoint.

    Estimated Savings: Approximately $494,000

6. **Construction Risk**
    a. By moving the PTB, and therefore reducing the effects of the 7 month time constraint that the TMTP can operate at half capacity, the District has reduced the risk to the Contractor of not having the PTB completed in the 7 month time period (during the winter months). It is anticipated that the Contractor would have built any risk of Liquidated Damages (LDs) into their Contract price and passed the LDs back to the District.

    Estimated Savings: Approximately $186,000 ($2000/day for 3 months)

    b. Reduce the risk associated with coordination between multiple Prime Contractors by eliminating the second contract for the generator project.

    Estimated Savings: Approximately $100,000

7. Unloading the Northern Slope

a. Thelen's original Geotechnical report recommended reducing the soil load on the existing slope north of the existing floc/sed basin. This can be accomplished by moving the GAC Feed PS and reducing the grade on top of the north slope. Reducing this load should help to prolong the integrity of this slope and reduce the slope creep that is taking place. Prolonging the integrity of this slope will allow the District to push back the date when more intensive stabilization of this slope will be required.

Estimated Savings: Approximately $614,000 (Present Worth of $1,000,000 project, at 5% interest, moved back 10 years)

8. Removing One Wall of PTB

a. By combining the GAC Building and the PTB, these buildings will share a common wall. Therefore, the cost of one CMU wall with brick veneer ($76,000) and the cost of brick veneer at the PTB foundation ($17,000) will be realized as a savings.

Estimated Savings: Approximately $93,000

9. Reduced Area of PTB Roofing

a. With the reduction of the overall footprint of the relocated PTB comes the subsequent cost savings associated with reducing the area of the roof. From the 30% design to the post VE preliminary design the roof of the PTB has been reduced by approximately 880 SF.

Estimated Savings: Approximately $130,000

10. Reduce The Depth of GAC Feed PS Wetwell

a. The finished floor elevation of the GAC Feed PS wetwell can currently be raised 4 feet without negatively affecting the vertical turbine pumps. Reducing the overall depth of the wetwell will save on the excavation and concrete walls for the wetwell.

Estimated Savings: Approximately $39,000

11. Reduced Length of Piping

a. From the preliminary redesign, it is anticipated that the following pipes and pump will be reduced in length and size:
   i. 24" GAC Supply
   ii. 24" GAC/UV Treated Water
   iii. 12" Secondary Backwash Supply
   iv. 6" GAC EQ Basin Recycle
   v. EQ Basin Pumps

Estimated Savings: Approximately $95,000

Northern Kentucky
Water District

January 7, 2010

Mr. Keith D. Logsdon, AICP
Deputy Director for Long Range Planning
Northern Kentucky Area Planning Commission
2332 Royal Drive
Fort Mitchell, KY 41017

SUBJECT: C-09-11-01/PF-99 Northern Kentucky Water District Improvements, Application for Project of Area wide Significance, Determination of Significance.

Dear Mr. Logsdon:

Thank you very much for working with us on our Taylor Mill Treatment Plant project. We very much appreciate the assistance and promptness that you have given us to help ensure that we meet all requirements and procedures related to demolishing the two houses on our property in order to make room for new construction.

We understand that the Taylor Mill Treatment Plant project qualifies as a "Project of Areawide Significance" and will not warrant a full scale review because of the extent of new activity. As you stated in your December 30, 2009 letter, you recommended approval of the proposed improvements with certain recommendations for consideration. NKAPC determined that this work falls within the parameters of KRS 100.324 (4) as a public facility and also recommends that the KCPC find this project in compliance with the Comprehensive Plan Update: 2006-2026 An Area-Wide Vision for Kenton County.

Additionally you suggested the following items:

1. Provide access to the GAC building off the existing access.

2. Landscape along the western boundary of the property to provide a visual buffer from the neighboring residential property and landscape along Grand Avenue to provide a buffer for residences located across the street.

3. Minimize the impact on Banklick Creek by minimizing the limits of disturbance and employ appropriate soil and erosion control measures during construction to minimize sedimentation and runoff into the creek, explore the use of storm water controls to accommodate on-site storm water treatment and discharge and enhance the riparian buffer area adjacent to Banklick Creek with additional planting.

4. Possibly use similar building materials as in the existing facility.

Fort Thomas Treatment Plant
Northern Kentucky Water District • 700 Alexandria Pike • Fort Thomas, Kentucky 41075
859-441-0482 • 859-572-4795 Fax

We appreciate your suggestions and will forward these on to our design engineers. Our treatment plant has been located in this community since 1955 and we continue to be very committed to being a good neighbor and hopefully helping to even enhance the aesthetics of the area.

Again, I would like to thank you very much for your assistance with this matter. If you need any additional information or have any questions or concerns, please feel free to contact me at any time.

Sincerely:

James Dierig

Mr. James Dierig, Maintenance Manager
859-547-3263 (w)
Dierig@nkywater.org

Northern Kentucky Area Planning Commission
Statement of Action

NUMBER: C-09-11-01 PF 99

WHEREAS Northern Kentucky Water District (through Jim Dierig) submitted an application requesting the Northern Kentucky Area Planning Commission review and make recommendations on an approximate 2-acre site located on Grand Avenue in Taylor Mill as the site for a new advanced treatment facility adjacent to their existing treatment plant as to its location, design, and extent of construction according to KRS 147.680; and

WHEREAS the staff of the Northern Kentucky Area Planning Commission reviewed the proposed site's location as well as the proposed project's design and extent of construction according to KRS 147.680; and

WHEREAS the Northern Kentucky Area Planning Commission met in open session at 5:15 PM on Monday, November 16, 2009, to consider staff's review of the Northern Kentucky Water District's application, to pursue questions of staff, and to pursue its responsibilities under KRS 147.680;

NOW, THEREFORE, the Northern Kentucky Area Planning Commission endorses the location, design, and extent of construction for the proposed advanced treatment facility in accordance with KRS 147.680 and provides the following recommendations and supporting information for the Northern Kentucky Water District's consideration.

RECOMMENDATIONS:

The Northern Kentucky Area Planning Commission recommends the following issues be considered as the project moves forward:

1. To minimize curb cuts on Grand Avenue, it is recommended that the access to the Grandular Activated Carbon (GAC) building (as shown in attached site plan) be provided off the existing access. The new access point on Grand Ave. does not meet the minimum 400 feet spacing requirement for collector streets per the Kenton County Subdivision Regulations.

2. The proposed access to the GAC building is located approx. 67 feet from an adjacent existing residence. Landseaping along the western boundary of the property should be considered to provide a visual buffer from the existing residential property located adjacent to the site. Landscaping along Grand Avenue would provide a buffer for residences located across the street.

3. The problems associated with the Banklick Creek Watershed are well documented through efforts of the Banklick Watershed Council. Storm water runoff from impervious surfaces has contributed to the deterioration of water quality and quantity of Banklick Creek. In order to minimize the impact on Banklick Creek the following should be considered:
   (a) Minimize the limits of disturbance and employ appropriate soil and erosion control measures during construction to minimize sedimentation and runoff into the creek.

(b) The usage of storm water controls such as rain gardens or swales should be explored to accommodate on-site storm water treatment and discharge.
(c) The riparian buffer area adjacent to Banklick Creek should be enhanced with additional planting.

4. Building materials similar to those used in the existing facility should be used for the new building.

Dennis A. Gordon, FAICP
Executive Director
Northern Kentucky Area Planning Commission

184-457

Northern Kentucky Water District

Memorandum

To: Ron Lovan

From: Amy Kramer

Date: January 7, 2011

Subject: Erosion Repair for TMTP Advanced Treatment

Please process the attached two copies of Agreement and the Project Proposal that covers design and construction phases services to repair the hillside and bank of the Banklick Creek as part of the TMTP Advanced Treatment project.

These services are needed to repair erosion that has been caused over the last 5 years or so and that will only get worse after the Advanced Treatment project if not addressed. Viox & Viox submitted a proposal for $10,120 that was lower than one received from Malcolm Pirnie for $29,000.

The additional engineering services outlined in the attached agreement will be charged to 184-457 for the TMTP Advanced Treatment Improvements project, with a total budget of $35,000,000. We have expended $2,154,019 to date and anticipate being below budget for this project.

Northern Kentucky Water District

PROJECT PROPOSAL – EROSION REPAIR

Project Description: TMTP Advanced Treatment Project

Project Funding: This effort will be funded as part of the District's 5-year capital budget, under PSC No. 136 with a total budget amount of $35,000,000.

Date: January 7, 2011

Background

The District selected Malcolm Pirnie to design improvements for adding advanced treatment at the TMTP. While Thelen was on-site doing borings and site reconnaissance for the project, they noticed that our treatment plant discharge had eroded the hillside significantly along its way to Banklick Creek. The engineer recommended we address the erosion or it will only continue to get worse. Improvements are needed to repair the erosion that has already occurred and to install a permanent solution that will prevent this from occurring again.

The plant has a KPDES permit that allows us to discharge process water as long as it meets certain water quality requirements. There are no limits on the volume we're allowed to discharge. Our discharges increased significantly in volume when the backwash treatment system went on-line in 2008. Prior to treating the backwash water and sending it to the creek, it was sent to sewer for an annual fee of $250,000. The other process that can discharge water to the creek is the filter-to-waste mode, but nearly 100% of this has been recycled to the head of the plant since going on-line in 2003.

After traveling through a pipeline toward the creek, this process water is discharged into the ground into a small area of rip rap. From there it flows over land for about 100 feet to the creek. It is this section between the end of the pipe and the creek that has eroded, cutting a 6-foot deep channel in the earth in some sections. The engineer has estimated the construction cost for this work to be in the range of $60,000 to repair. The proposed detention pond that will be constructed with the Advanced Treatment Project will also be piped to the same section, which will only exacerbate the problem.

The District received a proposal from Malcolm Pirnie to perform the necessary design and construction phase services as part of the Advanced Treatment project for $29,000. Staff believed this price was too high so Viox & Viox was contacted and requested to provide a proposal. Viox & Viox proposed a fee of $10,120 to complete the necessary design and construction services.

Proposed Work

Staff recommends executing an agreement with Viox & Viox to authorize the engineer to proceed with design and construction phase services to repair the hillside at TMTP adjacent to Banklick Creek for a fee of $10,120.

Cost Summary

The District has spent $2,154,019 on the project to date to develop preliminary and approximately 95% detailed design. The costs anticipated to complete the projects are shown below:

- Engineering Design Phase $ 1,761,440
- VE/Constructability Review $ 150,000
- Engineering Construction Phase $ 650,000
- Special Inspection & Testing $ 500,000
- Property Purchase $ 285,500
- Demolish houses $ 12,539
- Bids from Contractors $27,500,000
- *Viox Fees* *$ 10,120*
- *Erosion Repair Construction* *$ 60,000*

- TOTAL ESTIMATED COST: $30,923,099

- Project Contingency Remaining $ 4,076,901

Authorization Summary

The authorization for this amendment will allow staff to execute an amendment to the agreement with Viox & Viox for a not-to-exceed amount of $10,120 for design and construction phase services for repairing the bank along the creek at the TMTP as part of the Advanced Treatment project.

Submitted by,

Amy Kramer
Design Engineering Manager

Richard Harrison
V.P. Engineering & Distribution

APPROVED BY:

Ron Lovan
President/CEO

184-457
contracts

NORTHERN KENTUCKY WATER DISTRICT

PROFESSIONAL SERVICES AGREEMENT

Engineering Services for Erosion Repair at Taylor Mill Treatment Plant

THIS AGREEMENT is entered into this 11th day of January, 2011 (hereinafter the "Effective Date" by and between the Northern Kentucky Water District (hereinafter the "District") and Viox & Viox, Inc. (hereinafter the "Engineer"). The District and the Engineer shall be collectively referred to herein as the "Parties".

WHEREAS, the Engineer can provide professional services in connection with the construction of the design, bidding, and construction of improvements to repair erosion created by storm water and process water discharge at the Taylor Mill Treatment Plant (hereinafter the "Project"); and

WHEREAS, the District has need of the Engineer's services;

NOW, THEREFORE, in consideration of the mutual promises, agreements and covenants contained herein and other good and valuable consideration, the receipt and sufficiency of which is expressly acknowledged, the Parties agree as follows:

1. SCOPE OF SERVICES

The District hereby engages the Engineer to provide the services described in the document attached hereto as Exhibit A, which is incorporated as part of this Agreement. The Engineer shall not be obligated or authorized to perform any prospective services not included in Exhibit A unless and until the District and the Engineer agree to the particulars of the Engineer's services, compensation, and all other appropriate matters.

2. COMPENSATION

A. The Engineer shall be compensated for its services in accordance with the rates set forth in the document attached hereto as Exhibit B, which is incorporated as part of this Agreement. The Engineer agrees that in no event shall its compensation exceed $10,120 without written authorization from the District. It is understood that the amount of compensation shall include the standard hourly rates and reimbursable expenses set forth in Exhibit B.

B. The Engineer shall prepare and submit an itemized invoice for its services on a monthly basis.

C. The District shall pay all properly documented and undisputed amounts due under this Agreement, less any agreed upon retainage, within 30 days after receipt of each invoice.

D. The Engineer agrees that the District, upon reasonable request, shall have the right to conduct an audit of the Engineer's records to ensure compliance with this Agreement.

3. TERM AND TERMINATION

A. This Agreement shall be effective for two years from the Effective Date of the Agreement. This Agreement may be extended or renewed by mutual agreement of the parties, with or without changes, by written amendment establishing a new term.

B. The District shall have the right to terminate this Agreement at any time and for any reason by giving written notice thereof to the Engineer. Upon such termination, the Engineer shall prepare a final invoice and the District shall pay all properly documented and undisputed amounts set forth in the final invoice within 30 days after its receipt.

4. DELAY

A. The time for a party's performance will be extended to the extent performance was delayed by causes beyond the control and without the fault of the party seeking the extension. That party shall promptly notify the other party in writing when it is being delayed.

B. If Engineer's services are delayed or suspended in whole or in part by the District, or if Engineer's services are extended by a District's contractor's actions or inactions, through no fault of the Engineer, no equitable adjustment will be allowed or permitted for any incremental administrative costs for services outlined in the Agreement, that are incurred by the Engineer in connection with any delays, suspension or reactivation during the first 120 days following the commencement of any such event or events.

C. If Engineer's services are delayed or suspended in whole or in part by the District, or if Engineer's services are extended by a District's contractor's actions or inactions, through no fault of the Engineer, and the Engineer has notified the District in writing as provided in paragraph 4.A., the Engineer shall be entitled to an equitable adjustment of its compensation to reflect any increased technical and engineering services and/or oversight resulting from the delay or suspension that were not included in the amount of compensation stated in the Agreement.

5. INDEPENDENT CONTRACTOR RELATIONSHIP

A. The Engineer is and shall be in the provision of its services under this Agreement an independent contractor and not an employee, agent or servant of the District. All persons providing services pursuant to this Agreement shall at all times and in all places be subject to the sole direction, supervision and control of the Engineer. The relationship between the District and the Engineer (including Engineer's employees) shall in all respects be an independent contractor relationship and not an employer/employee or principal/agent relationship. Neither the Engineer or any of its employees or contractors shall have the authority to make any statements, respresentations, or commitments of any kind, nor take any other action, that would be binding on the District.

6. PROFESSIONAL RESPONSIBILITY

A. The Engineer agrees, in connection with the services provided pursuant to this Agreement, to exercise the standards of care, skill and diligence normally provided by competent engineering professionals in the provision of services similar to those contemplated by this Agreement. The Engineer shall take all reasonable safety precautions in the performance of this Agreement and shall comply with all occupational, safety and health laws and requirements.

B. The Engineer shall be responsible for the technical accuracy of its services and documents resulting therefrom, and the District shall not be responsible for discovering deficiencies therein. The Engineer shall correct such deficiencies without additional compensation except to the extent such action is directly attributable to deficiencies in information furnished by the District.

7. COMPLIANCE WITH LAWS; RELATIONSHIP WITH CONTRACTOR

A. The Engineer agrees that prior to providing any services under this Agreement, it will become familiar with all federal, state, and local laws, ordinances, regulations, orders and other requirements which in any way relate to the project. The Engineer further agrees that it will at all times and in all places observe and comply with all such laws, ordinances, regulations, orders and other requirements.

B. If the Engineer provides services during the construction phase of a project, the Engineer shall not supervise, direct, or have control over a contractor's work, nor shall the Engineer have the authority over or responsibility for the means, methods, techniques, sequences, or procedures of construction selected by a contractor, for safety precautions and programs incident to a contractor's work in progress, nor for any failure of a contractor to comply with laws and regulations applicable to a contractor's furnishing and performing the work. The Engineer neither guarantees nor assumes responsibility for the performance or acts of any contractor, subcontractor, supplier, or other project participant, not under contract to Engineer, to furnish and perform work not under contract with the Engineer.

8. MECHANICS' AND OTHER LIENS

A. The Engineer agrees and warrants that it will pay and satisfy bills and lawful claims (including but not limited to those submitted by Engineer's employees, agents, material-persons and suppliers) which Engineer may incur in connection with the performance of its obligations under this Agreement. In the event that any liens are filed against any property, or in the event that any claim is asserted against the District as a result of the acts or omissions of the Engineer in satisfying any such bills or claims, the Engineer shall, at its sole expense and within 10 calendar days from the date on which the District notifies the Engineer of such filing or assertion, promptly take action to cause the same to be discharged or withdrawn. This obligation of the Engineer shall survive the termination of this Agreement.

9. INDEMNITY

A. The Engineer shall defend, indemnify and hold harmless the District and the District's Commissioners, officers, agents and employees from and against any and all expenses, increased costs (including increased construction costs), claims, demands, investigations, suits, actions, damages and liabilities of which in any way are caused by or to the proportional extent arise from or are related to: (1) the negligence, gross negligence or willful misconduct of the Engineer or the Engineer's employees in performing under this Agreement; (2) any imprecision, incompleteness, errors, omissions, ambiguities or inconsistencies in the drawings, specifications or other design documents provided by the Engineer in performing under this Agreement (provided that increased construction costs will not include any costs the District would have incurred had the imprecision, incompleteness, error, omission, ambiguity or inconsistency not been present); (3) the failure of the Engineer or the Engineer 's employees to comply with federal, state, or local laws, ordinances, regulations, orders or other requirements in performing under this Agreement; or (4) the breach of or failure to comply with this Agreement by the Engineer or the Engineer 's employees. This indemnity shall survive the termination of this Agreement.

10. OPINIONS OF COST

A. The Engineer's opinions of probable construction cost (if any) are to be made on the basis of Engineer's experience and qualifications and represent Engineer's best judgment as an experienced and qualified professional generally familiar with the industry. However, since Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over a Contractor's methods of determining prices, or over competitive bidding or market conditions, the Engineer cannot and does not guarantee that proposals, bids, or actual Construction Cost will not vary from opinions of probable Construction Cost prepared by Engineer.

11. RELIANCE

A. The District shall be responsible for, and the Engineer may rely upon, the accuracy and completeness of all requirements, programs, instructions, reports, data and other information furnished by the District to the Engineer pursuant to this Agreement. The Engineer may use such requirements, reports, data, and information in performing or furnishing services under this Agreement.

B. Copies of District-furnished data that may be relied upon by the Engineer are limited to the printed copies (also known as hard copies) that are delivered to Engineer. Files in electronic media format of text, data, graphics, or of other types that are furnished by the District to the Engineer are only for convenience of the Engineer. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk.

12. INSURANCE

A. The Engineer shall take out and maintain, at the Engineer's expense, during the life of this Agreement, such comprehensive general liability insurance as shall protect the Engineer from claims for property damage, which may arise from any operations under this Agreement. Minimum required amounts are $2,000,000.00 in the aggregate and $1,000,000.00 for each occurrence.

B. The Engineer shall take out and maintain, at the Engineer's expense, during the life of this Agreement, comprehensive automobile liability insurance protecting the Engineer from claims for damages for bodily injury, including wrongful death, as well as from claims for property damage, which may arise from the ownership, use or maintenance of owned and non-owned automobiles, including rented automobiles, which may arise from any operations under this Agreement. Minimum required amounts are bodily injury limits of $500,000.00 per person and $1,000,000.00 per occurrence and property damage limits of $500,000.00 per occurrence.

C. The Engineer shall take out and maintain, at the Engineer's expense, during the life of this Agreement, adequate workers' compensation and employer's liability insurance in at least such amounts as are required by law or $500,000.00, whichever is greater, for all of Engineer's employees performing under this Agreement.

D. The Engineer shall take out and maintain, at the Engineer's expense, during the life of this Agreement, professional liability insurance with limits of not less than $1,000,000.00 in the aggregate.

E. Upon the District's request, the Engineer shall provide the District with Certificates of Insurance or other appropriate evidence that the insurance required by this Agreement has been obtained and will remain in force during the term of this Agreement. Such certificates or evidence shall include a written statement which provides that the District must be notified in writing at least 30 days before any change, modification or cancellation of the policy.

F. The obligation of the Engineer to carry the insurance required by this Agreement shall not limit or modify the Engineer's other obligations under this Agreement.

13. NON-ASSIGNABILITY OF AGREEMENT

A. The rights and duties of the Engineer under this Agreement shall not be assignable or delegable in the absence of the express written consent of the District. Unapproved subcontracts, assignments and delegations of this Agreement shall be void. In the event that the District approves a subcontract, assignment or delegation in writing, both the subcontractor, assignee or delegate and the Engineer shall be subject to all the terms and conditions of this Agreement.

14. CONFIDENTIALITY

A. The Engineer agrees and understands that all data and information, whether in oral, written, electronic or any other form, which is obtained, received, developed and/or produced by the Engineer and which relates to the vulnerability or security of any and all of the District's plants and facilities must be treated as confidential. All such data and information shall be referred to in this Agreement as "Confidential Information". With respect to all Confidential Information, the Engineer hereby agrees as follows:

(1) The Engineer shall not disclose any Confidential Information to any third party without the written consent of the District.

(2) The Engineer shall disclose Confidential Information to an employee of the Engineer only if the employee has a "need to know" in order to accomplish the purpose described in this Agreement. The Engineer further agrees to require all of its employees given access to Confidential Information to agree to maintain its confidentiality as required by this Section 14, by written agreement between each employee and the Engineer.

(3) The Engineer shall not use Confidential Information for its own benefit or for the benefit of any third party or for any purpose except as contemplated by this Agreement. Further, the Engineer shall not copy, digest, summarize or use Confidential Information, or any knowledge learned from Confidential Information, for any purpose except for the purpose contemplated by this Agreement.

(4) In the event that the Engineer becomes aware of any conduct by its employees, consultants or other third parties in contravention of the terms of this Section 14, the Engineer shall immediately take all action necessary: (a) to stop such conduct and prevent the same from reoccurring; (b) to retrieve from all recipients known to the Engineer any improperly disclosed Confidential Information and advise all such recipients in writing that any such Confidential Information is confidential; (c) to take such other affirmative steps to protect the Confidential Information as the Engineer would take to protect its own confidential or proprietary information; and (d) to advise the District of the breach and of the Engineer's remedial actions in connection with the breach.

B. The provisions of this Section 14 relating to Confidential Information shall continue for a period of 50 years from the date of this Agreement and shall survive the termination of this Agreement.

C. Notwithstanding anything to the contrary herein, the Engineer shall have no obligation to preserve the confidentiality of any information which:

a. Was previously known to the Engineer free of any obligation to keep it confidential; or

b. Is or becomes publicly available, by other than unauthorized disclosure.

15. EQUAL OPPORTUNITY

A. Unless exempted under KRS 45.590, during the performance of the Agreement, the Engineer agrees as follows:

1. Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age forty (40) and over, disability, veteran status, or national origin;

2. Contractor will take affirmative action in regard to employment, upgrading, demotion, transfer, recruitment, recruitment advertising, layoff, termination, rates of pay or other forms of compensation, and selection for training, so as to ensure that applicants are employed and that employees during employment are treated without regard to their race, color, religion, sex, age forty (40) and over, disability, veteran status, or national origin;

3. Contractor will state in all solicitations or advertisements for employees placed by or on behalf of Contractor that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age forty (40) or over, disability, veteran status, or national origin;

4. Contractor will post notices in conspicuous places, available to employees and applicants for employment, setting forth the provisions of the nondiscrimination clauses required by this section; and

5. Contractor will send a notice to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding advising the labor union or workers' representative of Contractor's commitments under the nondiscrimination clauses.

16. DISCLAIMER: ASBESTOS & HAZARDOUS WASTE/POLLUTION

A. The Engineer hereby states, and the District acknowledges, that the Engineer has no professional liability (errors and omissions) or other insurance, and is unable to reasonably obtain such insurance, for claims arising out of the performance of or failure to perform professional services related to asbestos or to hazardous wastes. The Engineer further acknowledges it will not perform work in these areas and if an asbestos, hazardous waste or pollution problem is identified on the District's site, a qualified consultant will be required. Accordingly, to the extent permitted under lay, the District hereby agrees to bring no claim for negligence or breach of contract against the Engineer for asbestos or hazardous waste generated by a third party.

17. DESIGN WITHOUT CONSTRUCTION PHASE SERVICES

A. It is understood and agreed that if Engineer's services do not include project observation, or review of a contractor's performance, or any other construction phase services, and that such services will be provided by the District or others, then the District assumes all responsibility for interpretation of the contract documents and for construction observation or review.

18. NOTICES

A. All notices, reports and other documents required to be submitted by this Agreement shall be submitted to the following address:

District

Northern Kentucky Water District
2835 Crescent Springs Road
P.O. Box 18640
Erlanger, KY 41018
(Note: Invoices should be marked to the attention of Amy Kramer)

Engineer

Viox & Viox
466 Erlanger Road
Erlanger, KY 41018
Attn: Carter Dickerson

19. GOVERNING LAW

A. This Agreement shall be interpreted, construed and enforced in accordance with the laws of the Commonwealth of Kentucky.

20. ENTIRE AGREEMENT

A. This Agreement consists of this instrument and the exhibits attached hereto and incorporated herein. This Agreement comprises the entire understanding between the Engineer and the District, and there are no other agreements, understandings, promises, or conditions expressed or implied, concerning the Project. This Agreement shall not be modified or amended except by a written instrument signed by the Parties.

B. If any provision of this Agreement shall be held invalid or unenforceable by a court of competent jurisdiction, the remainder of this Agreement shall remain in full force and effect.

21. NO WAIVER

A. The waiver by either Party of any breach or violation of any provision of this Agreement shall not operate or be construed as a waiver of any subsequent breach or violation.

22. COMPLIANCE WITH KENTUCKY LAW.

A. Engineer represents and warrants that it has revealed to District any and all final determinations of a violation of KRS Chapters 136, 139, 141, 337, 338, 341, and 342 within the previous five years. Engineer further represents and warrants that it will remain in continuous compliance with the provisions of KRS Chapters 136, 139, 141, 337, 338, 341 and 342 for the duration of this Agreement. Engineer understands that its failure to reveal a final determination of a violation or to comply with the above statutory requirements constitutes grounds for cancellation of the Agreement and for disqualification of Engineer from eligibility for any contracts for a period of two years.

IN WITNESS WHEREOF, the Parties have executed this Agreement as of the date first above written.

Viox & Viox, Inc.	Northern Kentucky Water District
Signature: ______	Signature: ______
Title: V.P.	Title: President/CEO

EXHIBIT A

Engineering Services for Erosion Repair at Taylor Mill Treatment Plant

SCOPE OF SERVICES

The District desires the Engineer to perform services for evaluation, design and construction of improvements for repairing erosion from the outfall at the Taylor Mill Treatment Plant. The Engineer will perform the following general tasks in support of the project:

- Prepare application for 404 Nationwide Permit.
- Conduct a threatened and endangered species assessment.
- Review requirements for constructing improvements in the floodplain.
- Development of a preliminary engineering report and opinion of probable construction cost.
- Field surveying of the proposed area.
- Detailed design and preparation of contract documents, including detailed drawings, bid sheets, specifications, and a detailed opinion of probable construction cost.
- Bid phase services including dissemination of the bid package to bidders, attendance at bid opening, preparation of bid tabulation, and written recommendation on award of contract.
- Construction phase services, including attendance at pre-construction conference, assistance with construction staking as necessary, and consultation and site visits during construction.

BACKGROUND INFORMATION

The District is experiencing severe erosion at the Taylor Mill Treatment Plant outfall in Kenton County, Kentucky. The outfall discharges storm water from the plant site and discharges process water (filter-to-waste and treated filter backwash). A combination of steep slopes, high flows, and lack of grade control along the effluent channel has caused the channel to erode. The depth of the erosion appeared to reach nearly 6 feet in some areas although this was not verified through measurement. From the outfall, the effluent channel flows north for approximately 100 feet before entering Banklick Creek, a tributary to the Licking River.

The District is in the process of designing improvements that will include a new stormwater detention pond near the existing outfall. The discharge pipe from the proposed detention pond will also discharge to the same outfall, which will only worsen the existing problem. Construction on the improvements under design by Malcolm Pirnie is expected to start in May 2011 and continue through late summer 2013.

According to a preliminary investigation by Malcolm Pirnie, the most recent U.S. Fish and Wildlife Service (USFWS) list of federal species of concern (dated June 2010) named 11 federally-listed species known to occur in Kenton County: Indiana bat (endangered), purple catspaw pearlymussel (endangered), clubshell (endangered), fanshell (endangered), Northern riffleshell (endangered), orangefoot pimpleback (endangered), pink mucket (endangered), ring pink (endangered), rough pigtoe (endangered), sheepnose (candidate), and running buffalo clover (endangered). An assessment of the area is needed to determine if these species are present. If forested areas to be cleared during project implementation are found to contain suitable potential Indiana bat habitat, the USFWS will likely require avoidance measures for the Indiana bat, such as cutting potential habitat outside of the roosting period. The roosting period occurs between April 1st and September 30th.

The Engineer shall evaluate and recommend improvements necessary to repair existing damage and control future erosion in the hillside or the creek. The District is open to installing buried infrastructure, open-channel improvements, or a combination. The Engineer shall evaluate options for correcting the situation including whether the outfall should be relocated and the existing damage repaired or if the existing area should be repaired in continued to serve as the outfall structure.

The specific scope of services and tasks to be performed by the Engineer are outlined in the tasks below.

PHASE 100 – PRELIMINARY ENGINEERING

Task 101 – Conduct Initial Meeting. The Engineer shall conduct a meeting between Engineer's project personnel and District's staff to discuss the project details, define lines of communication, confirm goals and objectives of the project, review study scope and schedule, and to request any data from the District. The initial meeting will include walking/driving the project with District's personnel to help identify potential issues. The Engineer shall review record information available and work with the District to coordinate the erosion repair with the District's Advanced Treatment project.

Task 102 – Site Assessment and Threatened and Endangered Species. The Engineer shall prepare and submit letters to the USFWS and the Kentucky Department of Fish and Wildlife Resources (DFWR) requesting the requirements for avoiding impacts to any species and/or their habitat that may be present within the project area.
The Engineer shall conduct a site visit to determine if potential Indiana bat habitat is present within the project area. The Engineer shall inspect the project area for running buffalo clover habitat and conduct a presence/absence survey for mussels at the confluence of the effluent channel and Banklick Creek. The results of these assessments will be included in the informational request to the USFWS and DFWR.

Task 103 – Prepare Preliminary Engineering Report. The Engineer shall prepare a preliminary engineering report summarizing the findings of the site assessment. As part of the engineering report, the Engineer shall prepare and submit a preliminary opinion of probable construction cost. The Engineer shall provide recommendations for any additional investigations or explorations that may be required prior to detailed design, such as Geotechnical borings. The Engineer shall submit two (2) copies of the report and meet with the District to present the findings. Upon approval of the engineering report by the District, detailed design will commence as directed by the District.

PHASE 200 – DETAILED DESIGN

Task 201 – Perform Topographical Survey. The Engineer shall perform a topographical survey of the site. Survey all infrastructure locations, above and below ground (telephone, storm sewer, sanitary sewer, electric, gas, cable, fiber optics, traffic loops, underground electric lighting, street car tracks, structure footings, etc.) existing and proposed, including size and flow direction, if applicable; locations for geotechnical borings, if appropriate; any structures within the project limits; vegetation; house addresses; and watercourses.

The Engineer shall confirm right-of-ways by courthouse research, if necessary to determine property lines.

Accuracy shall be sub-centimeter horizontal and vertical. Horizontal control shall be based on NAD 83 Kentucky State Coordinate System (North Zone). Vertical control shall be based on NAVD 88.

All data collection shall be accomplished on TDS Data Collection Software, G.P.S. Equipment or equivalent

Any and all survey work must refer to said elevations and baseline.

The Engineer shall establish benchmark elevations and a baseline to utilize in the design and construction of the improvements.

Task 202 – Coordinate with Utilities and Advanced Treatment Project. The Engineer shall show all existing features, edge of pavement, fences, mailboxes, telephone poles, culvert pipes, and any relevant information on preliminary plan drawings including proposed work as part of the Advanced Treatment project in the vicinity of the erosion repair. The Engineer shall submit a set of these preliminary drawings to all utility companies that own and operate facilities in the project area, in accordance with applicable laws and regulations. The District shall be copied on all correspondence to any agency or utility regarding the project.

The Engineer shall show all utility information and relevant proposed improvements received from the utility companies and the District on the project drawings. All manholes, telephone chambers, valve chambers, and electric chambers shall also be shown.

Task 203 – Perform Detailed Design. The Engineer shall perform the detailed design of the improvements recommended in the preliminary design report. The design will culminate in the preparation of contract documents for bidding the project. Prepare the contract documents as described below:

Design Drawings. Design drawings for construction of the work shall be in accordance with Northern Kentucky Water District standards. Complete a cover sheet that includes a title, vicinity map, and index. Prepare design drawings in AutoCAD Version 14 format or above. Upon completion of the final design, provide electronic files of the drawings to the District. All final design drawings shall be stamped by a Professional Engineer licensed in the State of Kentucky.

Show and label test boring locations on the project drawings. Clearly label all existing utilities, stations, streets, and pertinent information on the drawings which shall include temporary and permanent easement areas. Show and label in the profile view all existing utilities that cross the proposed water main. Any special considerations of natural/manmade obstacles (e.g. river/creek/railroad crossings) must be evaluated and satisfactorily addressed in the design.

Front-End and Technical Specifications. Front-end and technical specifications for the construction of all work shall be in accordance with Northern Kentucky Water District standards. Incorporate standard front-end specifications (Instructions to Bidders, Notice to Bidders, General Conditions and Supplementary Conditions, Technical Specifications, Prevailing Wage Rates if applicable, and any others deemed necessary) provided by the District. In addition to the standard front-end sections, include the total number of construction days (calendar) for substantial completion and final completion for the bid notification.

Task 204 – Conduct Review Meetings. The Engineer shall meet with the District at the 50 percent and 90 percent complete stages of the design to review the project. For the review meetings, bring five (5) copies of the plans. Prepare and distribute meeting minutes of key decisions made at the meetings.

Task 205 – Prepare Contract Documents and Opinion of Probable Construction Cost. The Engineer shall prepare and assemble contract document in accordance with guidelines outlined herein and incorporate any comments from the District from the final review. Contract documents may include drawings, front-end specifications, technical specifications, geotechnical reports, or any other information requested by the District.

The Engineer shall review the completed project specification for completeness, accuracy, and applicability which includes the District's standard front-end specifications. The Engineer shall prepare and submit to the District a detailed opinion of probable construction cost based on the final set of contract documents.

The Engineer shall prepare up to a total of twenty-five (25) sets of contract documents and submit five (5) to the District. The Engineer shall incorporate any and all necessary considerations for best management practices regarding storm water runoff and erosion control, as required by Sanitation District #1.

PHASE 300 – PERMITTING

The Engineer shall prepare any applications/permits/plans needed for stream crossing and/or land disturbance & submit to the appropriate agencies which include the following: Nationwide Permit (NWP) Preconstruction Notification, Application for General Certification for Water Quality Certification (WQC), Application for Permit to Construct Across or Along a Stream, Application for Kentucky Pollutant Discharge Elimination System (KPDES), Notice of Intent for Storm Water Discharges (NOI-SW), Storm Water Pollution Prevention Plan (SWPPP), Corps of Engineer Permits, etc. These permits at a minimum are anticipated:

Task 301 – Floodplain Coordination. Based on the Advanced Treatment project review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) 21117C0017E, dated March 16, 2009, portions of the project area lie within the 100 year floodplain. The Engineer shall coordinate with the local floodplain administrator to ensure that the project meets all federal, state, and local floodplain guidelines. It is assumed that a Permit to Construct Across or Along a Stream from the KDOW will be required for any construction in the floodplain. The Engineer shall complete an Application for Permit to Construct Across or Along a Stream and submit, with the design drawings, to the local floodplain administrator for approval and signature. Upon local approval, this information will be submitted to the KDOW for final approval. It is assumed that flood modeling will not be required for this project since the improvements are intended to restore previous ground elevations.

Task 302 – Section 404 and 401 Permit. It is likely that some fill material will need to be placed below the banks of Banklick Creek to restore the effluent channel. Banklick Creek is a jurisdictional water of the U.S. subject to jurisdiction under Sections 404 and 401 of the Clean Water Act (33 U.S.C. 1344 and 1341). Based on preliminary review of the project components, it appears that the project may be authorized under Nationwide Permit (NWP) No. 13 as part of the Section 404 approval process. The Engineer shall confirm if projects authorized under this NWP receive automatic 401 Water Quality Certification from the Kentucky Division of Water (KDOW) provided that the general and specific regional conditions are met. The Engineer shall prepare a pre-construction notification (PCN) for NWP approval and submit to the U.S. Army Corps of Engineers (USACE). An on-site pre-application meeting with the USACE may be necessary.

Because a Section 404 Permit constitutes a federal action, coordination with the appropriate agencies for threatened and endangered species, cultural resources, stormwater and floodplains will also be necessary. It is assumed the cultural resources clearance can be conducted through the USACE and the 404 permit process.

PHASE 400 – BID PHASE SERVICES

The Engineer shall make the contract documents available to prospective bidders by keeping copies of the entire bid package in Engineer's office for review and purchase, plus mail bid packages to potential bidders by request.

The Engineer shall respond in writing to any questions received from prospective bidders.

The Engineer shall prepare addenda to clarify, correct or change the contract documents, if necessary.

The Engineer shall attend the bid opening, assist in evaluation of bids, and make a recommendation concerning award of the contract.

PHASE 500 – CONSTRUCTION PHASE SERVICES

The Engineer shall attend the Pre-construction Conference and bring up to five (5) complete sets of project plans and specifications for the contractor.

The Engineer shall review and distribute approved shop drawings and other information. The Engineer shall provide assistance with needed field changes by the contractor to ensure compliance with the contract documents.

The Engineer shall conduct up to three site visits to confirm the contractor is following the contract documents.

Upon completion of the project, the Engineer shall revise the drawings to conform to as-built information maintained by the contractor and furnished by the owner. Provide the District with one full-sized set of as-build drawing and one electronic copy on CD.

PHASE 600 – PROJECT DESIGN ADMINISTRATION AND MANAGEMENT

The Engineer will provide project supervision, direction, and coordination with the District's management and staff for Phases 100 through 500 as described above. Review correspondence, activities, project design billing, conduct in-house reviews, prepare status reports, and conduct discussions with the District's staff as necessary. Perform project clerical work. Any and all other tasks not listed in this Scope of Services and those described below shall be considered as supplemental services.

EXHIBIT B

Engineering Services for Erosion Repair at Taylor Mill Treatment Plant

PAYMENTS TO ENGINEER

The District shall pay the Engineer an amount equal to the cumulative hours charged to the project by each class of Engineer's employees time at the Standard Hourly Rates for each applicable billing class for all services performed on the Project, plus reimbursable expenses and Engineer's subconsultants, if any. The Engineer agrees that in no event shall its compensation (including expenses) exceed $9,700 without written authorization from the District.

Standard Hourly Rates include salaries and wages paid to personnel in each billing class plus the cost of customary and statutory benefits, general and administrative overhead, non-project operating costs, and operating margin or profit. Engineer's Standard Hourly Rates to be used during the term of this Agreement are attached to this Exhibit B as Appendix 1.

The amounts billed for Engineer's services will be based on the cumulative hours reasonably charged to the Project during the billing period by each class of Engineer's employees times Standard Hourly Rates for each applicable billing class, plus the below reimbursable expenses and Engineer's subconsultant's charges, if any.

The following reimbursable expenses reasonably incurred during the performance of the project shall be paid at cost:

a. Travel by commercial carrier, meals, lodging, rental car, and incidental travel costs approved by the District in advance.
b. Long distance phone calls.
c. Vehicle mileage at IRS approved rate at time of travel.
d. Reproduction of reports, drawings, and specifications.
e. Postage and shipping charges.
f. Subconsultants costs, approved by the District in advance.
g. Rental charges for equipment approved by the District in advance.

The Standard Hourly Rates shall be deemed to include all other expenses not listed herein or expressly stated in the Agreement to the contrary.

APPENDIX 1 TO EXHIBIT B

Engineering Services for Erosion Repair at Taylor Mill Treatment Plant

STANDARD HOURLY BILLING RATES

TITLE	DESCRIPTION	RATE ($ PER HOUR)
Principal	Person having overall responsibility for conduct of the project, including contract negotiation and issue resolution.	130
Project Manager	Person serving as primary point of contact on project administrative items and is responsible for technical accuracy of project, assigning personnel, and managing project budget and schedule.	90
Senior Project Professional	Person reviewing accuracy of and advising project team on technical issues for preparation of reports, opinions of probable construction cost, and recommendations.	113
Project Professional	Person preparing reports, opinions, and recommendations for project and conducting preliminary and detailed design.	95
Staff Professional	Person involved in specific project assignments such as performing calculations, assisting in preparation of preliminary and detailed design, and running computer programs.	85
Senior Technician	Person having advanced drafting skills and judgment involved in preparation of design.	80
Technician	Person with advanced drafting skills that assists in preparation of design with moderate supervision.	60
Junior Technician	Person with basic drafting skills and familiarity with technical terms and symbols that assists in preparation of design with significant supervision.	55
Construction Administrator	Person who works closely with team to verify intent of design, attends progress meetings, and inspects work for compliance with contract documents.	85
Word Processing & Office Support Staff	Person who performs clerical work, word processing, filing, and related administrative tasks.	40

Northern Kentucky Water District

BOARD OF COMMISSIONERS COMMUNICATION

Meeting Date:	Subject:	Number:
June 8, 2011	**Consideration of Bids for the Erosion Remediation Project at the Taylor Mill Treatment Plant**	6

Attachments:	Agenda Location:	Action Required:
• Map • Bid Tab	Commission Action Items	☐ Information Only ☒ Motion

Prepared by:	Kyle Ryan	**Presentation by:**	Richard Harrison

KEY CONSIDERATIONS:

- The District is experiencing severe erosion downstream of an existing outfall at the Taylor Mill Treatment Plant.
- The District used to send filter backwash water to SD1 and paid significant sanitation costs (Over $200,000 annually) until a treatment system was installed to treat the backwash water. The District was able to secure a Kentucky Pollution Discharge Elimination System Permit (KPDES) from the Kentucky Division of Water to allow the discharge of this water to the Banklick Creek. This additional flow is primarily causing the erosion that needs to be repaired.
- This outfall is located approximately 200' west of the existing chemical building and discharges storm and plant process water. From the outfall, water is discharged into an earthen drainage swale approximately 175' in length which eventually flows into Banklick Creek.
- Over the past few years, this drainage swale has become increasingly eroded and is now 6 to 8 feet deep in some places.
- Staff recommends that the problem be addressed before it worsens from current or future operations.
- The Erosion Remediation Project at the Taylor Mill Treatment plant will:
  - restore and stabilize the eroded creek bank with added fill, geotextile support, and plantings;
  - create a new outfall with a shallow pool to slow the velocity of the discharged water;
  - construct a boulder stair stepped waterfall to deliver the water to the creek elevation.
- The engineer's estimate prepared by Viox & Viox, Inc. for the Erosion Remediation Project at the Taylor Mill Treatment Plant is $ 185,000.00.
- The District received a total of seven (7) bids for the project.
- The low bid of $139,612.50 was submitted by Hale Contracting Co., Inc. who has no work history with the District but was recommended by Viox & Viox, Inc. based on satisfactory references that were also checked by District staff.

BUDGET/STAFF IMPLICATIONS:

- The project will be funded by the District's 5-year Capital Budget under PSC No. 136 "TMTP Advanced Treatment and Sedimentation Basin & Generator" with a total budget of $35,000,000. The District will have some labor expense to inspect the project.

RECOMMENDATION:

- Staff recommends that the Board **authorize the execution of the contract documents for the Erosion Remediation Project at the Taylor Mill Treatment Plant to award the project to Hale Contracting Co., Inc.** because they submitted the best bid and this project is needed to provide an acceptable method of discharge of water from our facility.

BACKGROUND/HISTORY:

- While conducting borings and site reconnaissance for the new Taylor Mill Treatment Plant Advanced Treatment Project, an engineer from Thelen Associates observed that the District's plant discharge had severely eroded the hillside and creek bank along Banklick Creek and brought it to our attention.
- District staff originally requested a proposal from Malcolm Pirnie to perform the necessary design and construction phase services as part of the Advanced Treatment Project. Staff also requested a proposal from Viox & Viox to perform the necessary design and construction services for the erosion remediation project as a stand-alone project.

BID TAB

Northern Kentucky Water District
Erosion Remediation Project at the Taylor Mill Treatment Plant
Taylor Mill, KY

May 26, 2011

CONTRACTOR	BID AMOUNT
Hale Contracting Co., Inc.	$139,612.50
Smithcorp, Inc.	$147,882.73
Dudley Construction	$163,984.15
Brass Eagle, Inc.	$163,988.00
Evans Landscaping Inc.	$166,551.00
D. L. Braughler Co., Inc.	$195,568.36
Paul Michels & Sons, Inc.	$207,076.46

EXHIBIT 19
FINAL GEOTECHNICAL REPORT

RECEIVED
SEP 14 2010
MALCOLM PIRNIE, INC.
CINCINNATI, OHIO

FINAL REPORT

GEOTECHNICAL EXPLORATION

ADVANCED TREATMENT FACILITIES

TAYLOR MILL TREATMENT PLANT

GRAND AVENUE

TAYLOR MILL, KENTUCKY

Prepared for: **Malcolm Pirnie, Inc.**

Thelen Project No.: **081069E**

THELEN ASSOCIATES, INC.

www.thelenassoc.com

Geotechnical • Testing Engineers

• 1398 Cox Avenue, Erlanger, Kentucky 41018-1002 / 859-746-9400 / Fax 859-746-9408

Offices
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Lexington, Kentucky
Cincinnati, Ohio
Dayton, Ohio

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Offices
Erlanger, Kentucky
Lexington, Kentucky
Cincinnati, Ohio
Dayton, Ohio

September 10, 2010

Malcolm Pirnie, Inc.
8600 Governor's Hill Drive
Suite 210
Cincinnati, Ohio 45249-1388

Attn: Mr. Chris Weber

Re: **FINAL REPORT**
Geotechnical Exploration
Advanced Treatment Facilities
Taylor Mill Treatment Plant
Grand Avenue
Taylor Mill, Kentucky

Ladies and Gentlemen:

Summarized in this report are the results of our geotechnical exploration performed for the proposed site improvements including the Granular Activated Carbon (GAC) and Preliminary Treatment Building, the GAC Feed Pump Station Building, the detention pond, retaining walls, substation and generator pads at the existing Northern Kentucky Water District (NKWD) Taylor Mill Treatment Plant on Grand Avenue in Taylor Mill, Kentucky.

The proposed GAC and Preliminary Treatment Building will be constructed on the two (2) vacant parcels immediately west of the existing Grand Avenue vehicle entrance to the facility. The proposed GAC Feed Pump Station will be located in the southern half of the footprint for the southern existing Clarifier/Flocculator. An electrical substation and two (2) generator pads are also proposed within the remaining footprint of the southern Clarifier/Flocculator and the southern half of the northern Clarifier/Flocculator.

The existing Clarifier/Flocculators and tunnel will be demolished to allow the construction of these structures. The geotechnical work included test borings, laboratory testing, engineering analysis, and preparation of this report.

We have included in the Appendix to this report a reprint of "Important Information About Your Geotechnical Engineering Report" published by ASFE, Professional Firms Practicing in the Geosciences, which our firm would like to introduce to you at this time.

We appreciate the opportunity to provide the consulting services for this project and will be pleased to answer any questions that you may have regarding the data, conclusions and recommendations summarized in this report.

Respectfully submitted,
THELEN ASSOCIATES, INC.

Michelle E. Sperber

Michelle E. Sperber, P.E.
Staff Geotechnical Engineer

STATE OF KENTUCKY
MICHELLE E. SPERBER
24688
LICENSED
PROFESSIONAL ENGINEER

Theodore W. Vogelpohl

Theodore W. Vogelpohl, P.E.
Principal Geotechnical Engineer

MES/TWV:tmk
081069E

Copies submitted: 3 – Client
1 – GRW Engineers, Inc.

STATE OF KENTUCKY
THEODORE W. VOGELPOHL
14509
LICENSED
PROFESSIONAL ENGINEER

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THELEN ASSOCIATES, INC.

www.thelenassoc.com

Geotechnical • Testing Engineers

• 1398 Cox Avenue, Erlanger, Kentucky 41018-1002 / 859-746-9400 / Fax 859-746-9408

Offices
Erlanger, Kentucky
Lexington, Kentucky
Cincinnati, Ohio
Dayton, Ohio

September 10, 2010

FINAL REPORT
GEOTECHNICAL EXPLORATION
ADVANCED TREATMENT FACILITIES
TAYLOR MILL TREATMENT PLANT
GRAND AVENUE
TAYLOR MILL, KENTUCKY

1.0 INTRODUCTION

Presented in this report are the results of our geotechnical exploration for the proposed Advanced Treatment Facility Improvements at the Northern Kentucky Water District (NKWD) Taylor Mill Treatment Plant. The main purpose of this exploration was to determine the general subsurface profile at the site and to relate the engineering properties of the soil and bedrock, that is their classification, strength and compressibility characteristics, to the proposed structure foundation designs and to site development. The geotechnical work included test borings, laboratory testing, engineering analysis, and preparation of this report.

2.0 PROJECT DESCRIPTION

The NKWD Taylor Mill Treatment Plant is located at the northwest corner of the intersection of Grand Avenue with Howard Street in Taylor Mill, Kentucky. Our understanding of the originally proposed site development was based on the Taylor Mill Advanced Treatment Improvements Basis of Design Report published by the Designer (Malcolm Pirnie, Inc. of Cincinnati, Ohio) in January 2009. We submitted an original Report of Geotechnical Exploration, dated May 22, 2009 based on the originally proposed site development. Design revisions were subsequently made as shown on the updated site plan from GRW Engineers, Inc., received by us on May 24, 2010. The proposed facility upgrades and design revisions include a merged Granular Activated Carbon (GAC) and Preliminary Treatment (PT) Building, a relocated GAC Feed Pump Station, an electrical substation, three (3) generator pads, and associated supply/discharge pipelines from the GAC Feed Pump Station to the GAC/PT Building as part of the treatment plant improvements. A Draft Revised Report of Geotechnical Exploration was submitted on June 11, 2010 based on these design revisions.

A final site plan has been completed, which includes the same design revisions as described in the previous paragraph, with the exception of the elimination of the third generator pad. The site improvements and proposed grading are shown on "Yard Piping – Storm Sewers", Sheet C-02-312 dated June 2010.

2.1 GAC/PT Building

The proposed GAC/PT Building will be constructed on the southwest corner of the existing NKWD property, with the western access drive located on the two (2) vacant parcels located immediately west of the existing Grand Avenue vehicle entrance to the facility. The homes that were previously located on the vacant parcels have been demolished.

According to the updated drawings provided by Malcolm Pirnie, Inc. and GRW Engineers, Inc., the proposed GAC/PT Building will now include the following:

- Maintenance and Equalization (EQ) Basin Area (below the Maintenance Area), 27 feet x 54 feet, Maintenance Area Finished floor elevation (FFE) 524.0 feet (Mean Sea Level Elevation), EQ Basin FFE 512.5 feet.
- Flocculation Basins (Four Total), 22 feet by 22 feet each and 45.5 feet by 45.5 feet in overall plan dimension, FFE 517.5 feet.
- Sedimentation Basins (Two Total), 38 feet x 38 feet each and 78 feet by 38 feet in overall plan dimension, FFE 512.5 feet (sides) and FFE 510.5 feet (center).

- Truck Aisle, 153 feet by 20 feet, FFE 524.0 feet.
- Pump Room (Below East End of Truck Aisle), 18 feet by 18 feet, FFE 504.0 feet.
- Vessel Area, 47 feet x 145 feet, FFE 524 feet.
- Administrative Area, 36 feet x 40 feet, FFE 524.0 feet.

Based on the proposed and existing grades, cuts up to 21 feet deep will be required for the pump room and up to about 12.5 feet for the northern half of the GAC/PT Building area and up to 3 feet for the southern half of the building.

The maximum column loads for the GAC/PT Building will be 260 kips. The bearing pressure at the flocculation basins will be 1.5 kips per square foot (ksf) with an exterior wall bearing pressure of 3 ksf. The bearing pressure at the sedimentation basins will be 2.5 ksf, with an exterior wall bearing pressure of 3 to 4 ksf.

2.2 GAC Feed Pump Station, Electrical Substation & Generator Pads

The GAC Feed Pump Station will be located within the southern half of the footprint for the southern existing Clarifer/Flocculator. The subgrade elevation of the wet well is proposed at 506.5 feet and the FFE of the building will be 524.0 feet. The bearing pressures at the GAC Feed Pump Station will be the same as the sedimentation basins, 2.5 ksf with an exterior wall bearing pressure of 3 to 4 ksf.

The electrical substation and generator pads will be located within the remaining footprint of the southern Clarifier/Flocculator to the north of the proposed GAC Feed Pump Station, the existing tunnel and the northern Clarifier/Flocculator. The finished grade of this area is not yet finalized, but it is our understanding that the exterior grades will be near Elevation 521.5 to 522.5 feet, which may require minimum cut amounts for site grading. It is our understanding that the existing Clarifier/Flocculators and tunnel will be demolished to allow the construction of these structures from the south side of the project site. The FFE of the existing tunnel is at 516.6 feet and the FFE of the existing Clarifier/Flocculators ranges from 508.5 to 515.0 feet. Based on these existing grades and the proposed grades in this portion of the site, excavations up to 14 feet will be required to demolish the existing structures and fill will be required to bring the areas up to finished exterior grades and the FFE of the GAC Feed Pump Station floor.

2.3 Pavement Areas, Retaining Walls & Fill Embankment

A parking lot is proposed immediately east of the GAC/PT building, to the north of the truck entrance into the building. A truck access drive is also proposed from the west wall of the GAC/PT building to the north edge of Grand Avenue. The truck access drive will be constructed on the two (2) vacant parcels of land to the west of NKWD property. The proposed finished grade of the parking lot will range from 523.0 to 524.0 feet.

Three (3) retaining walls are planned in the GAC/PT Building area. Retaining Wall 'A' will be located along the north/west shoulder of the truck access drive on the west side of the proposed building. The height of this wall will range from about 6 to 10 feet. The proposed finished grade of the truck access drive will transition from 524.0 feet at the west edge of the building, down to a low spot at El. 523.0 feet where a storm sewer will be installed and then back up to El. 530.0 feet at Grand Avenue. Retaining Wall 'B' will be located along the north edge of the eastern parking lot and will have a maximum height of about 3.5 feet. Retaining Wall 'C' will be located near the southeast corner of the proposed GAC/PT Building, along the administrative area, and will have a maximum height of about 5 feet.

A 5 to 7-foot tall, 3.5 Horizontal to 1 Vertical (3.5H:1V) fill embankment is also planned to the north of the shoulder for the truck access drive. A drainage channel will be constructed along the west edge of the proposed fill embankment. The proposed fill embankment will transition to a 4H:1V cut slope to the north of the proposed GAC/PT Building.

2.4 Utilities

There will be multiple utility/pipe lines extending from the existing Chemical and Filter Buildings, the GAC Feed Pump Station Building, the GAC/PT Building and into the north drainage swale. It is our understanding that all of the pipe will be internally restrained due to the proximity of these lines to other existing and proposed utilities, as well as existing and proposed structures. Sheet C-02-312 shows the specific alignment of each of the proposed pipelines, which include the following:

- A 24-inch diameter Raw Water Main that will connect the proposed GAC/PT Building to an existing water main on Howard Street. The profile for this water main is shown on Sheet C-02-301 of the Project Plans.

- A 24-inch diameter GAC Supply Line that will connect the proposed GAC/PT Building to the GAC Feed Pump Station. The profile for this line is shown on Sheet C-02-309 of the Project Plans.

- A 24-inch diameter GAC/UV Treated Water line that will connect the proposed GAC/PT Building and the existing Chemical Building. The profile for this alignment is shown on Sheet C-02-310 of the Project Plans.

- A permanent 42-inch diameter filter influent pipe that will connect the proposed GAC/PT building to the existing filter building. The profile for this alignment is shown on Sheet C-02-305 of the Project Plans.

- A temporary 24-inch diameter filter influent pipe will connect into the completed portion of the 42-inch filter influent pipe and be routed along and braced to the remaining portion of the north wall of the existing northern Clarifier/Flocculator after the initial site demolition. The profile for this alignment is shown on Sheet C-02-305 of the Project Plans.

- A 24-inch diameter GAC Feed Pump Station Supply line that will connect the proposed GAC Feed Pump Station to the existing Filter Building. The profile for this alignment is shown on Sheet C-02-307 of the Project Plans.

- A 24-inch diameter GAC Feed Pump Station Overflow that will connect the proposed GAC Feed Pump Station to a drainage area at the toe of the existing fill embankment at the northwest corner of the existing Chemical Building. The profile for this alignment is shown on Sheet C-02-308 of the Project Plans.

- A 54-inch diameter Chemical Feed Trench that will connect the existing Chemical Building to the proposed GAC/PT Building. The detail for this trench is shown on Sheet C-02-305 of the Project Plans.

- Several other smaller diameter storm sewers and drain lines as shown on the Sheet C-02-312.

2.5 Detention Pond

The proposed detention pond will be located at the toe of the 4H:1V cut slope to the north of the proposed GAC/PT Building. The southern side slope of the detention pond will continue along with the 4H:1V cut slope. The northern side of the detention pond will consist of a berm with side slopes having a gradient of 3H:1V and a top elevation of 503.0 feet.

3.0 SITE TOPOGRAPHY AND GEOLOGIC CONDITIONS

This project site is located in Northern Kentucky within the Outer Bluegrass Physiographic Region, characterized by hilly, well-dissected upland areas and relatively steep-sided stream and river valleys. The project site slopes downward to the north from Grand Avenue to Banklick Creek, with local relief on the order of 70 feet. Roughly 4500 feet east of the project site Banklick Creek drains into the Licking River, which in turn, drains northward into the Ohio River.

Available geologic mapping (Geologic Map of the Covington Quadrangle, KY, USGS, 1971) indicates the project site is underlain in descending order by Quaternary Age Fluvio-Lacustrine overburden material, and Upper Ordovician Age bedrock of the Kope and Point Pleasant Formations. The bedrock is noted to consist of interbedded shale and limestone. In the Kope Formation the shale comprises a minimum of 85 percent of the total and occurs in beds ranging from less than 1 inch to sets 8 feet thick. It is described in the mapping as medium-light gray, greenish gray, and medium gray, laminated and locally crosslaminated, commonly fissile, slightly calcareous and silty, locally slightly pyritic; with whole or broken small fossils sparse to locally abundant. The limestone makes up less than 15 percent of the total, is described as medium to dark gray, fine to coarse grained, argillaceous, and locally fossiliferous; it is noted to occur in layers from 2 to 12 inches thick. In the Point Pleasant Formation, the shale comprises 30 to 55 percent of the unit and occurs in beds up to 15 inches thick. It is described as medium dark gray to olive and greenish gray, non-calcareous to locally highly calcareous, moderately fissile and generally fossil poor. The limestone comprises 45 to 70 percent of the unit and occurs in beds from less than 2 inches to several feet thick. It is described as medium light gray to medium gray and light brownish gray, coarse to fine-grained, fossiliferous, and in irregular to even beds.

No faults are noted to be present by the referenced mapping within the immediate vicinity of the project site.

4.0 SUBSURFACE EXPLORATION

Thelen Associates, Inc. (Thelen) personnel carried out the fieldwork phase of this exploration between December 10 and December 21, 2009 and between March 5 and March 8, 2010. Seventeen (17) test borings, numbered GAC-101 through GAC-105, DP-1, DP-2, GAC-1 through GAC-5, GAC-8, and SED-1 through SED-4, were drilled specifically for this project at the locations shown on the Revised Boring Plan, Drawing 0810691E-100, in the Appendix to this report. The updated version of Sheet C-02-312 was used as a base map for the Revised Boring Plan. The test borings were staked in the field by Thelen personnel, with the locations and surface elevations surveyed by personnel from GRW Engineers, Inc. of Louisville, Kentucky. Our test boring locations from several previously performed explorations at the project site are also shown on Drawing 081069E-100.

The test borings made for this project were advanced using a track-mounted drill rig advancing hollow stem augers. Standard Penetration testing (using split-spoon samplers) and undisturbed thin-wall (Shelby) tube sampling were accomplished ahead of the augers following the procedures outlined in ASTM D1586 and D1587, respectively. Rock coring was performed in selected test boring locations using an NXM core barrel per ASTM D2113. Observations for groundwater were made in the borings during drilling, at completion of drilling and after completion of drilling.

As each test boring was advanced, the Drilling Technician kept a log of the subsurface profile noting the soil and bedrock types and stratifications, groundwater, penetration test results, and other pertinent data. Particular attention was given to the textures, colors, moisture contents, and consistencies of the materials encountered. Representative portions of the split-spoon samples were placed in labeled glass jars. The ends of the Shelby tubes were capped and taped to preserve the in situ moisture contents and densities of the undisturbed samples.

Groundwater measurements were made in the boreholes during drilling, at the completion of drilling, and at time intervals following the completion of drilling. These groundwater measurements are noted at the bottoms of the test boring logs. In addition, a piezometer was installed in Test Boring GAC-2 so that groundwater measurements could be made after the borehole was backfilled.

5.0 LABORATORY REVIEW AND TESTING

The samples from the test borings were examined and visually classified in the laboratory by the Project Geotechnical Engineer. Representative samples were selected from the test borings made specifically for this project for natural moisture content determinations, Atterberg limits testing, unconfined compression tests on soil and bedrock, one dimensional consolidation testing and a moisture-density test. Soil classification identifications were developed in accordance with the Unified Soil Classification System (USCS). Thelen personnel performed laboratory testing in accordance with the applicable ASTM methods for soil and rock testing. The results of the testing are included in the Tabulation of Laboratory Tests in the Appendix along with the unconfined compressive strength test forms.

Final test boring logs for the test borings made specifically for this project were prepared by the Project Geotechnical Engineer on the basis of the visual classification in the laboratory, the laboratory test results and the field logs kept by the Drilling Technician. Copies of the final test boring logs are included in the Appendix with Soil and Bedrock Classification Sheets, which describe the terms and symbols used on the boring logs. Copies of test boring logs from previous explorations made by Thelen at the TMTP are also provided in the Appendix, and these boring locations are shown on the Boring Plan, Drawing 081069E-1 in the Appendix.

The dashed lines on the test boring logs indicate an approximate change in soil or bedrock strata as estimated between samples. A solid line indicates a change in strata occurred within a sample where a more precise measurement could be made. The transitions between soil and bedrock types may be abrupt or gradual.

Rock Quality Designations (RQD's) were recorded for each bedrock coring run. The RQD is defined as the sum of the lengths of all pieces of intact core longer than 4 inches in a coring run, divided by the total length of the run. This value is then multiplied by one hundred to express the result as a percentage. The RQD provides a qualitative indication of rock quality. RQD values are presented on the Log of Test Boring sheets in the Appendix to this report. Table 1 included below shows the correlation of RQD values with Rock Mass Quality.

Table1. Relation of RQD to In-Situ Rock Quality*

RQD Percent	Rock Mass Quality
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
0-25	Very Poor

***From Naval Facilities Engineering Command, NAVFAC D.M. 7-1 (1982)**

6.0 SITE CONDITIONS

To simplify the description of the site conditions, the project site has been divided into two separate areas: 1.) GAC/PT Building and 2.) GAC Feed Pump Station, Substation & Generator Pads. The proposed structure locations are shown on the Revised Boring Plan, Drawing 081069E-100, in the Appendix to this report.

6.1 GAC/PT Building

As noted previously, the proposed GAC/PT Building and associated drives and parking lots will be located in the southwest corner of the NKWD property and on the vacant parcels immediately west of the existing Grand Avenue vehicle entrance to the facility. Previously, there were two (2) existing houses and garages with associated concrete and asphalt driveways on the two (2) parcels west of the NKWD property. Both of the previously existing residences have been demolished. It is our understanding that the foundations associated with these residences have been removed and that the excavations were backfilled with a non-engineered, undocumented fill. It is noted that the contours shown on the updated site plan indicate that fill was placed over the sloping ground for the driveway and detached garage of the western residence, and that an area was leveled for a pool to the north of this fill for the western residence.

In general, the ground surface in this area of the project site slopes gently downward to the north through the proposed GAC Building area, then more steeply downward to the northeast into a swale that drains to the north into Banklick Creek. There is an existing 36-inch diameter water main buried beneath the ground east of the proposed GAC/PT Building location, and a 42-inch diameter water main beneath the ground parallel to Grand Avenue south and east of the proposed GAC/PT Building location. There are also buried storm and sanitary sewers northeast and east of the proposed GAC/PT Building location.

The proposed GAC/PT Building area, and the drainage swale to the northeast of this area, were once used as a stockpile area for soil and pavement excavated from water main repair projects. Remnants of the stockpiled fill are still present in this area.

6.2 GAC Feed Pump Station, Substation & Generator Pads

As shown on the Boring Plan, the proposed GAC Feed Pump Station, Substation and Generator Pad locations are currently occupied by the existing north and south Clarifier/Flocculators between the existing Filter and Chemical Buildings, as well as an existing tunnel that connects the Chemical and Filter Buildings. The ground surface immediately north of the Clarifier/Flocculators slopes steeply downward to the north to Banklick Creek. There is a history of landsliding on this slope, with the estimated headscarp of the historic landslide noted on Drawing 081069E-100 in the Appendix to this report. This slope is discussed further in Section 10.4 of this report.

It is our understanding that the existing plant will remain in operation throughout construction of the entire project. The sequence of construction includes the following:

- Construct the proposed GAC/PT Building.

- Install a portion of the permanent 42-inch diameter filter influent line from the beginning at Station 10+00 to near the existing residuals pump station, bringing the pipe above the existing ground surface and then connecting a temporary 24-inch diameter filter influent line that will be braced to the north wall of the existing northern Clarifier/Flocculator.

- Demolish the existing south Clarifier/Flocculator, existing tunnel and all but the north wall of the existing northern Clarifier/Flocculator, from the south side of the project site in order to avoid construction activity on the northern slope. The north wall of the north Clarifier/Flocculator where the temporary 24-inch diameter pipe is braced will remain in place until construction is complete.

- Install the remaining portion of the permanent 42-inch diameter filter influent line. Complete demolition of the north wall of the north clarifier.

- Construct the proposed GAC Feed Pump Station, generator pads and substation.

As noted above, in order to construct the proposed GAC Feed Pump Station, Substation and Generator Pads, the existing north and south clarifier and flocculation basins and tunnel must be demolished and the foundations removed. Excavations will be required from roughly 10 to 15 feet below existing grade (below elevations 508.5 to 516.6 feet) to remove these foundations and up to 20 feet to construct the GAC Feed Pump Station. Based on the design drawings for the Chemical Building (CH2M Hill, 1999), the Chemical Building foundation bears at approximate elevation 516 feet. Based on the design drawings for the Filter Building (Alfred LeFeber and Associates, 1953), the Filter Building basement foundations bear at approximate elevation 508 feet. It is also understood that the existing residuals pump station will be abandoned by cutting off the top at the ground surface and filling in the approximately 30-foot deep structure.

In addition, it should be noted that previous compaction grouting has been performed near the northwest corner of the existing northern Flocculator/Clarifer basin. Our research indicates that there was a shoring failure during construction of the existing residuals pump station, and as a result, settlement of the northwest corner of the existing basin occurred. Grout was injected into the ground below the bottom of the basin through pipes that were inserted around and beneath the northwest corner of the basin. The Contractor should be aware of the presence of the grout.

7.0 SUBSURFACE CONDITIONS

Based on our interpretation of the geologic mapping, the test borings and laboratory testing, the project site is generally underlain by fill material, followed by fluvio-lacustrine sedimentary soils, silty clay colluvial materials, and finally interbedded shale and limestone bedrock. Asphalt and/or concrete were encountered at the ground surface within parking and driveway areas.

The following discussion of subsurface conditions is based on all of the referenced test borings, both those made specifically for this project and those made for previous explorations. The reader is cautioned that the previously performed test borings were made from ground levels that existed before previous construction at the site, that grade changes were made as part of those site improvements, and that these grade changes need to be taken into account when estimating the subsurface conditions from those boring logs. It should be recognized that the depths and thickness of pavement, soil and bedrock types shown on the historic test boring logs do not necessarily reflect depths and thickness from the existing ground surface.

References to laboratory test results in this report are only for those laboratory tests made on samples from the recent test borings made specifically for this project. No laboratory test results from the previous explorations are included or referenced in this report.

7.1 GAC/PT Building & Detention Pond

Test Borings GAC-101 through GAC-105; GAC1 through GAC5; 108, 110, 111 and 112 (970209E); and 7 and 8 (050386E) are within the vicinity of the proposed GAC/PT Building Area. It is noted that this proposed building has been relocated several times in the planning stages of the project, which is why none of these test borings are coincident with the building corners and walls.

7.1.1 Asphalt/Topsoil

Test Boring GAC-104 encountered 3 inches of asphalt in the existing residence drive. Test Boring GAC-102 encountered a 6-inch thick layer of topsoil beneath the fill, below a depth of 8.0 feet. Test Boring GAC-103 encountered a 6-inch thick layer of topsoil beneath the fill, below a depth of 2.0 feet. Test Borings GAC-101 and GAC-105 encountered 5 inches of topsoil at the ground surface. Test Borings 111 and 112 (970209E) encountered 3 and 5 inches of topsoil, respectively, at the previously existing ground surface.

7.1.2 Fill

Fill materials were encountered in all of the test borings, with the exceptions of GAC-101 and 105, directly beneath the existing or the previously existing ground surface, varying in thickness from 2.0 to 17.0 feet. The recovered samples generally consist of mixed brown to olive or dark brown, dark green, gray, and/or black silty clay or clay matrix containing various percentages of topsoil, roots, twigs, cinders, shale, sand, gravel, wood, brick, carpet, limestone fragments and floaters, organics, concrete pieces, and/or asphalt fragments. The materials were generally moist, and ranged in consistency from soft to very stiff. Standard Penetration Resistance values (N-values) for these materials typically ranged from 4 to 45 blows per foot (bpf) with an average value of about 12 bpf. Natural moisture content testing of jar samples yielded values ranging from 13.2 to 25.8 percent, with an average moisture content of 18.6 percent. One (1) sample classified as a CL soil according to the USCS with a liquid limit of 38 percent and a plasticity index of 16 percent.

7.1.3 Valley Bottom Sedimentary Soils

Test Borings 7 and 8 (050386E) were drilled near the center of an old buried valley and encountered swale sediments beneath the fill. The valley sediments were encountered below a depth of 17.0 feet beneath the ground surface at the time the test borings were drilled. The sediment was 0.9 and 2.5 feet thick in Test Borings 7 and 8 (050386E), respectively. N-values of the medium stiff or stiff sediment were 17 and 19 bpf. The sediment was described as greenish brown and gray or grayish brown with traces of green and was noted to have organic staining and trace roots.

7.1.4 Fluvio-Lacustrine Sedimentary Soils

The ground surface, the asphalt and/or the fill are underlain by sedimentary soils of fluvio-lacustrine origin. These soils were deposited in irregular beds by either moving water (fluvial) or relatively still water (lacustrine or lakebed) sources. The fluvial materials are associated with a pre-existing drainage valley running in a generally southeast to northwest direction. These materials were encountered in all the borings at this location and ranged in thickness from about 1 to 21.5 feet. The recovered samples generally consist of brown or olive brown and/or gray, moist, medium stiff to very stiff, silty clay, with and without iron oxide stains, roots, silt seams and limestone or shale fragments. N-values for this material ranged from 5 to 27 bpf with an average value of about 14 bpf. Natural moisture content testing on several jar samples yielded values ranging from 17.1 to 26.7 percent, with an average moisture content of 21.9 percent. Four (4) samples of this material classified as CL and CL-ML according to the USCS. The CL-ML sample exhibited a liquid limit (LL) of 27 percent and a plasticity index (PI) of 6 percent. The CL samples exhibited liquid limits of 47, 31 and 31 percent with corresponding plasticity indices of 24, 10 and 12 percent, respectively. Unconfined compressive strength testing of five (5) undisturbed samples yielded strength values ranging from 2,620 to 4230 pounds per square foot (psf), with an average value of about 3,333 psf and an average natural dry density of 104.4 pounds per cubic foot (pcf). One Dimensional Consolidation testing of two (2) undisturbed samples yielded compression index (C_c) values of 0.196 and 0.176 and recompression index (C_r) values of 0.043 and 0.067.

Lakebed clay materials within the project vicinity were typically deposited within fresh water lakes formed during periods of advancing and retreating glacial activity. These materials were encountered in Test Borings GAC-102, GAC-1 and GAC-2 in thicknesses of 11, 2 and 3.5 feet, respectively. The recovered samples generally consist of orange-brown to brown or brown to bluish gray, moist, stiff to very stiff plastic clays. N-values of this material ranged from 13 to 20 bpf, with moisture contents of 20.7, 22.4, 24.1 and 25.6 percent, respectively. Two (2) samples of the plastic clay classified as CH soil according to the USCS with liquid limits of 51 and 57 percent and corresponding plasticity indices of 25 and 30 percent.

7.1.5 Colluvial Soils

Colluvial materials were encountered underlying the sedimentary materials in Test Borings GAC-101, GAC-103 through GAC-105, GAC-2, GAC-4, GAC-5, and 8 (050386E). These deposits are typically formed by the downslope transport of soil and rock material under the influence of gravity. The recovered samples generally consist of brown and/or gray, moist, stiff to very stiff, silty clay with randomly oriented limestone and shale fragments. N-values ranged from 9 to 26 bpf, with an average value of about

17 bpf. Natural moisture content testing yielded values ranging from 15.8 to 24.3 percent, with an average moisture content of 18.4 percent. Two (2) samples of this material classified as CL soil according to the USCS, with a LL of 45 and 39 percent and a PI of 19 and 17 percent. Unconfined compressive strength testing of one (1) undisturbed sample yielded a strength of 2,920 psf with a natural dry density of 104.0 pcf.

7.1.6 Bedrock

A bedrock formation consisting of a system of interbedded shale and limestone layers was encountered below the fill, sedimentary, and/or colluvial soils. As previously noted, the bedrock is a system of Ordovician Aged shale and limestone, and correlates well with the Kope Formation on the referenced mapping. Bedrock in the Northern Kentucky Area is typically characterized in three basic zones depending upon the degree of weathering. The uppermost zone is termed highly weathered interbedded shale and limestone, where the shale portion has virtually weathered to a brown silty clay or clay, yet possesses horizontally aligned bedding characteristics of the bedrock system and may contain clay seams. The intermediate zone is described as olive brown weathered bedrock and is characterized by a shale component that is tougher, and generally at lower moisture contents, than the highly weathered zone above. The upper and intermediate zones have weathered from the third commonly accepted zone, the unweathered, gray, parent interbedded shale and limestone. The limestone component of the highly weathered to unweathered bedrock consists of relatively unweathered 1- to 2-inch horizontal beds, which are gray, crystalline, fossiliferous and hard. Highly weathered and weathered zones, locally, may or may not be present above the unweathered bedrock zone because of variable weathering and erosion conditions.

The top of the highly weathered zone was encountered in Test Borings GAC-101, GAC-102, GAC-104, GAC-1, GAC-2, and GAC-5 beneath the colluvium or the lakebed clays, at depths of 34.0, 40.5, 17.0, 28.0, 39.5, and 28.0 feet, respectively. The thickness of this zone ranged from 2.5 to 6.0 feet. Moisture content testing on four (4) samples from the shale portion of the highly weathered zone yielded values ranging from 11.6 to 18.0 percent, with an average value of 20.6 percent.

The top of the intermediate weathered zone was encountered in Test Borings GAC-103, GAC-104, GAC-3 and GAC-4 beneath the colluvium, at depths of 14.5, 19.5, 28.0 and 22.0 feet, respectively. The thickness of this zone ranged from 5.0 to 6.0 feet. Moisture content testing on two (2) samples from the shale portion of the intermediate zone yielded values of 9.0 and 6.8 percent.

The upper boundary of the parent, gray shale and limestone bedrock was encountered in the Test Borings below depths ranging from 17.0 to 43.0 feet. Moisture content testing on five (5) samples from the shale portion of the parent bedrock yielded values ranging from 5.7 to 17.6 percent, with an average value of 9.3 percent.

Twelve (12) feet of the bedrock was cored in the bottom of Test Boring GAC-3. The recovered core consisted of interbedded gray, moist, very weak to weak, moderately weathered to unweathered, medium bedded, calcareous shale, trace gray, medium strong, unweathered, fine-crystalline grained, thin bedded limestone. The limestone was in 1- to 2-inch thick beds and comprised 2.5 percent to 8.3 percent of the cored interval. Overall RQD values of the recovered rock core were 40 and 46 percent, with an average value of 43 percent. This represents a Rock Mass Quality of 'Poor' as shown in Table 1 of this report. One sample of the shale from this core tested to a moisture content of 5.7 percent, a dry density of 153.5 pounds per cubic foot (pcf), and an unconfined compressive strength of 67.2 kips per square foot (467 pounds per square inch).

7.2 GAC Feed Pump Station, Substation & Generator Pads

Test Borings SED-1 through SED-4; GAC-8; 101, 102 and 109 (970209E); 1 and 2 (86079E); 4 and 8 (87189E); and ICM 101 (010777E) were performed in the vicinity of the proposed GAC Feed Pump Station, Substation and Generator Pad areas.

7.2.1 Asphalt/Concrete

Asphalt and/or concrete pavement was encountered in Test Borings SED-1 through SED-4 in thicknesses ranging from 0.6 to 1.0 foot. Asphalt was also encountered beneath the previously existing ground surface in Test Borings 101 and 109 (970209E) with thicknesses of 7 and 10 inches, respectively. Test Boring 2 (86079E) encountered 1.0 foot of concrete at the previously existing ground surface.

7.2.2 Fill

Fill materials were encountered in Test Borings SED-1, SED-2, GAC-8, 101, 102 and 109 (970209E), 1 (86079E), 4 (87189E) and ICM 101 (010777E) directly beneath the existing or previously existing ground or pavement surface, varying in thickness from 2.0 to 14.5 feet. The recovered samples generally consist of a mixed brown, dark brown, olive brown, and/or gray silty clay or clay matrix containing various percentages of topsoil, decayed wood and leaves, grass, limestone, shale, gravel, sand, roots, and/or asphalt, pieces of glass, black organic matter and brick fragments. However, a sample recovered from Test Boring SED-2 consisted of mixed gray and brown, moist, very dense sand and gravel. The recovered cohesive samples were generally moist, and ranged in consistency primarily from soft to stiff. N-values for the cohesive materials ranged from 3 to 16 bpf with an average value of about 8 bpf. Natural moisture content testing of jar samples yielded values ranging from 18.2 to 28.5 percent, with an average moisture content of 23.1 percent. The N-value of the coarse grained sample was 66 bpf, with a natural moisture content of 2.5 percent.

7.2.3 Sedimentary Soils

The fill materials or the previously existing ground surface are underlain by sedimentary soils of fluvio-lacustrine origin. Fluvial sedimentary soils were encountered in all the test boring locations and ranged in thickness from about 5 to 56 feet. The recovered samples generally consist of brown, gray, reddish brown, and/or olive brown, moist, medium stiff to very stiff, clay, silty clay, or clayey silt, with and without iron oxide stains, silt seams, shale and limestone fragments or floaters. N-values for this material ranged from 3 to 31 bpf with an average value of about 9 bpf. Natural moisture content testing on thirty-two (32) jar samples yielded values ranging from 16.6 to 29.9 percent, with an average moisture content of 23.8 percent. Two (2) samples of this material classified as CL according to the USCS with liquid limits of 30 and 33 percent and plasticity indices of 11 and 12 percent.

Lakebed clay materials were encountered in all test borings, with the exception of 101, 102 and 109 (970209E), 1 and 2 (86079E), 4 and 8 (87189E), where the test borings were not extended to the deeper strata. The thicknesses of the lakebed clay strata ranged from 5 to 10 feet. The recovered samples generally consist of mottled brown to olive brown, dark gray, and/or gray to bluish gray, moist, medium stiff silty clays and stiff to very stiff plastic clays. N-values of seven (7) samples of this material ranged from 9 to 17 bpf, with an average value about 11 bpf. Natural moisture content testing on five (5) jar samples yielded values ranging from 19.5 to 23.4 percent, with an average moisture content of 21.5 percent. One (1) sample of the plastic clay classified as a CH soil according to the USCS with a LL of 55 percent and a PI of 32 percent.

7.2.4 Colluvial Soils

Colluvial materials were encountered interbedded with and/or underlying the sedimentary materials in all test borings made specifically for this project, in beds ranging from about 5 to 16 feet in thickness. Recovered cohesive samples generally consisted of brown to olive brown and gray to bluish gray, moist, stiff to very stiff, silty clay with randomly oriented limestone and shale fragments. One non-cohesive sample in Test Boring GAC-8, directly above the bedrock surface, consisted of brown, wet, very dense, silty, fine to coarse, sand and gravel. This sand and gravel is not of colluvial origin, but rather glacial outwash similar to that encountered in the historic test borings beneath the slope down to Banklick Creek to the north. N-values of eleven (11) cohesive samples ranged from 13 to 32 bpf, with an average value of about 23 bpf. Two (2) standard penetration tests were noted to refuse on limestone floaters, and were not included in the average. Natural moisture content testing on eight (8) jar samples yielded values ranging from 12.8 to 21.3 percent, with an average moisture content of 18.2 percent. One (1) sample of the coarse grained material had an N-value of 79 bpf and a natural moisture content of 10.4 percent. One (1) sample of the cohesive colluvium classified as CL according to the USCS, with a LL of 33 percent and a PI of 15 percent.

7.2.5 Deep Granular Soils

Test Boring ICM 101 (010777E) encountered a layer of gray very dense fine to coarse gravel beneath the lakebed clay at a depth of 63.3 feet below the ground surface at the time the test boring was drilled. The layer was 4.7 feet thick and the N-value was greater than 50 bpf.

7.2.6 Bedrock

The bedrock formation beneath this area is the lower Kope Formation and upper Point Pleasant Formation of the Ordovician Bedrock. This bedrock is typically characterized in three basic zones, similar to that described in Section 7.1.5 of this report. The highly weathered bedrock zone was not encountered in the test borings at this location. The top of the intermediate weathered zone was encountered in Test Boring SED-2 beneath the colluvium at a depth of 48.5 feet. Moisture content testing on one (1) sample from the shale portion of the intermediate zone yielded a value of 14.5 percent.

The upper boundary of the parent, gray shale and limestone bedrock was encountered in Test Borings SED-1, SED-3, SED-4 and GAC-8, below depths of 59.0, 58.0, 63.0, and 68.5 feet, respectively. Moisture content testing on eight (8) samples of the gray shale yielded values ranging from 1.6 to 11.2 percent, with an average value of 5.8 percent.

Twelve (12) feet of the bedrock was cored in the bottom of Test Boring GAC-8. The recovered core consisted of interbedded gray, moist, extremely weak to weak, slightly weathered to unweathered, thin to medium bedded, calcareous shale and gray, strong to very strong, unweathered, thin to medium bedded, medium to coarse crystalline grained, locally fossiliferous limestone. The limestone was in 1- to 8-inch beds and comprised 34.4 percent to 37.5 percent of the cored interval. Overall RQD values of the recovered rock core were 25 and 49 percent, with an average value of 37 percent. This represents a Rock Mass Quality of 'Poor' as shown in Table 1 of this report. One sample of the shale from this core tested to a moisture content of 6.1 percent, a dry density of 145.3 pcf, and an unconfined compressive strength of 70.8 kips per square foot (approximately 492 pounds per square inch (psi). One sample of the limestone from this core tested to a moisture content of 0.2 percent, a dry density of 168.8 pcf, and an unconfined compressive strength of 2,532.8 kips per square foot (approximately 17,589 psi).

7.3 Originally Proposed Detention Pond Locations

A detention pond was originally proposed farther to the north of the proposed fill embankment for the western truck access drive. Test Borings DP-1 and DP-2 were drilled in the vicinity of this location as part of the second set of test borings for the project. A second detention pond location was also proposed on the north side of the northern cut slope for the proposed GAC/PT Building. After performing a stability analysis, it was determined that the second location was preferred from a hillside stability standpoint. The discussion of the subsurface profile in this section is only in regards to the test borings (DP-1 and DP-2) performed in the vicinity of the abandoned northwest detention pond location. The subsurface profile for the second and chosen location is similar to that discussed in Section 7.1 for the proposed GAC/PT Building, which includes the native fluvio-lacustrine sedimentary soils, silty clay colluvial materials, and the interbedded shale and limestone bedrock.

7.3.1 Overbank Deposits and Topsoil

Test Borings DP-1 and DP-2 were performed in the area of the original northwest detention pond. Test Boring DP-1 encountered 1.7 feet of dark brown, medium stiff overbank deposits consisting of silty clay. Test Boring DP-2 encountered 4 inches of topsoil.

7.3.2 Sedimentary Soils

Beneath the overbank deposits or the topsoil, Test Borings DP-1 and DP-2 encountered the native fluvio-lacustrine sedimentary soils to a depth of 19.5 and 14.5 feet. This material was described as mottled brown, dark brown, and/or gray, medium stiff to very stiff silty clay or clayey silt and partially varved in some samples. The N-values of this material ranged from 6 to 16 bpf. Several moisture content tests were performed on samples of this material which yielded values ranging from 19.4 to 25.6 percent. One (1) sample classified as a CL soil according to the USCS with a LL of 39 percent and a

PI of 16 percent. One (1) undisturbed sample yielded an unconfined compressive strength of 1,190 psf with a natural dry density of 101.8 pcf.

7.3.3 Colluvial Soils

The native colluvium was encountered in Test Borings DP-1 and DP-2 below a depth of 19.5 and 14.5 feet, respectively. The native colluvium was described as mottled olive brown or brown stiff silty clay with shale fragments and limestone floaters. The N-values of the colluvium ranged from 13 to 17 bpf. These test borings were terminated within the colluvium and did not encounter the surface of the bedrock.

8.0 GROUNDWATER

Based on our local experience, groundwater can occur at the fill soil/native soil interface, within deposits of coarse-grained soils, within the sedimentary soils, at the native soil/bedrock interface, and along limestone layers within the bedrock. It should be noted that drilling operations were conducted in December and March, during a regionally wet period. There may be seasonal fluctuations of the groundwater based on temperatures and/or precipitation amounts. Individual groundwater readings can be found at the bottoms of the test boring logs in the Appendix to this report.

8.1 GAC/PT Building & Detention Pond

Groundwater was encountered in all of the recent test borings for the GAC Building, with the exception of GAC-105 and GAC-4, at depths ranging from about 10 to 45 feet below the existing ground surface during drilling. At the completion of drilling, groundwater was encountered in Test Boring GAC-101, GAC-102 and GAC-3 at depths of about 40, 44 and 20 feet below ground surface, respectively. After the completion of drilling operations, water readings were taken prior to backfilling the boreholes in some of the borings, and groundwater was detected at depths varying from about 10 to 33 feet below ground surface. Groundwater was measured in the piezometer in Boring GAC-2 at depths of 33.6 feet and 32.8 feet at 23 days and 57 days after completion of drilling, respectively. Groundwater was not encountered in historic Test Borings 111 and 112 (970209E) in the area of the proposed detention pond.

8.2 GAC Feed Pump Station, Substation & Generator Pads

Groundwater was encountered in all of the recent test borings in this area at depths ranging from about 11 to 63 feet below the existing ground surface during drilling. At the completion of drilling, groundwater was detected in Test Borings SED-2, SED-3, and GAC-8 at depths ranging from about 22 to 44 feet below ground surface. Water level readings were acquired after the completion of drilling in all test borings and groundwater was detected at depths ranging from about 8 to 25 feet. It was noted that surface water from a recent rain event was draining from the pavement surface into the top of Test Boring SED-4.

8.3 Originally Proposed Detention Pond Location

Groundwater was encountered in Test Borings DP-1 and DP-2 at depths of 11.0 and 12.5 feet during drilling, respectively. Upon completion of drilling, Test Boring DP-1 encountered groundwater at a depth of 17.2 feet. Both test borings were backfilled immediately and long-term water readings were not taken.

9.0 FOUNDATION ANALYSES

We recommend that bedrock-bearing deep foundations be utilized for support of the proposed GAC/PT Building due to the variable quality and depth of the fill and native overburden materials underlying the ground surface at this location. Initially, two (2) types of bedrock-bearing foundations were considered for foundations at this site including augered cast-in-place concrete (augercast) piles and conventional reinforced concrete drilled shafts. Based on the finalized location of the proposed GAC/PT building, we recommend that only the conventional drilled shafts be considered for foundation support. For the purposes of this report, it is assumed that the drilled shafts will be socketed from 1 to 3 feet into the unweathered parent interbedded shale and limestone bedrock. Procedures used herein to estimate axial capacities of the deep foundations are outlined in the Federal Highway Administration publication FHWA-IF-99-025, "Drilled Shafts: Construction Procedures and Design Methods", 1999. Allowable axial compressive capacities for drilled shafts are presented in Section 10.5.1.1 of this report. Lateral capacity estimates were beyond the scope of this work;

however, Thelen is available, if required, to consult with the Structural Engineer about lateral loads as the project designs are finalized.

Based on the proposed location and wet well bearing elevation of the GAC Feed Pump Station, it is our opinion that the proposed GAC Feed Pump Station can be supported on a structural slab (mat) foundation bearing in the medium stiff to stiff native silty clay below the fill. Allowable bearing capacities of mat foundations were determined using the general Meyerhoff Method. The remaining portion of the GAC Feed Pump Station building may be supported with shallow spread footings bearing in the replaced compacted and tested fill. These foundation recommendations are discussed in further detail in Section 10.5 of this report.

10.0 CONCLUSIONS AND RECOMMENDATIONS

10.1 General

It is our understanding that the proposed improvements to the Taylor Mill Treatment Plant facility will consist of a new GAC/PT Building to replace the existing Clarifier and Flocculation Basins, three (3) retaining walls, a new GAC Feed Pump Station, a new Substation and Generator Pads, piping associated with the new and existing buildings, and a detention pond.

Based upon the test borings, a visual examination of the samples, the laboratory tests, our understanding of the proposed construction, and our experience as Consulting Soil and Foundation Engineers in the Northern Kentucky Area, we have reached the conclusions and make the recommendations in this report.

If conditions are encountered in the field during construction which vary from the facts of this report, we recommend that our office be contacted immediately to review the changed conditions in the field and make appropriate recommendations.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater or air, on or below or around this site.

We have performed the test borings and laboratory tests for our evaluation of the site conditions and for the formulation of the conclusions and recommendations of this report. We assume no responsibility for the interpretation or extrapolation of the data by others.

The earthwork and foundation recommendations of this report presume that the earthwork and foundation construction will be monitored continuously by a qualified Engineering Technician or Engineer under the direction of a Registered Professional Geotechnical Engineer. We recommend that the Owner contract these services directly with a qualified testing agency under the direction of a Registered Professional Engineer.

We recommend that a preconstruction meeting be held at the site with the Owner's representative(s), the Design Engineer, the Project Structural Engineer, the General Contractor, the Excavating Contractor, the Geotechnical Engineer and any other interested parties to review the scope and schedule of the proposed earthwork and foundation installation.

10.2 Subsurface Conditions and Seismicity

The project site is generally underlain by fill material, followed by fluvio-lacustrine sedimentary soils, silty clay colluvial materials, and finally interbedded shale and limestone bedrock. Asphalt and/or concrete were encountered at the ground surface within existing parking and driveway areas.

Based on the test borings and our interpretation of Kentucky Building Code 2007 Edition (KBC 2007) and its approved amendments to date, it is our opinion that the following seismic parameters will be applicable for the proposed water treatment facility:

Seismic Occupancy Category	III (Assumed, to be verified by Designer)
S_S	0.193g
S_1	0.079g
Site Class	D
F_a	1.6
F_v	2.4
S_{MS}	0.309g
S_{M1}	0.190g
S_{DS}	0.206g
S_{D1}	0.126g
Seismic Design Category (short period)	B
Seismic Design Category (one second period)	B

10.3 Site Preparation and Earthwork Operations

Grading for this project will include both cuts and fills. Cuts will be required for the proposed GAC/PT Building, the proposed GAC Feed Pump Station wet well, the demolishing of the existing clarifiers and tunnel, as well as for the cut slope and a portion of the proposed detention pond. The cuts are anticipated to be on the order of 0 to 21 feet deep. It is anticipated that conventional track-mounted equipment will be able to readily excavate the existing fill and cohesive and/or granular overburden soils at this site.

In regards to the deep excavations required for construction of the below grade features in the GAC/PT Building, the demolition of the existing Clarifier/Flocculator Basins and the tunnel, and the proposed GAC Feed Pump Station wet well, we note that the Contractor should be responsible for the stability and safety of all excavations and should exercise all necessary cautions to shore or otherwise maintain stable excavations to protect workers, as well as adjacent ground, structures and infrastructure. All excavations should be made and maintained in accordance with all Federal, State and Local regulations.

Particular regard to the safety of excavations should be given between the existing Chemical and Filter Buildings. As previously noted, excavations will be required from roughly 10 to 15 feet below existing grade (below elevations 508.5 to 516.6 feet) between these buildings. The updated site plan shows the proposed structures will be approximately 20 to 45 feet from the existing Chemical and Filter Building Walls. Based on the design drawings for the Chemical Building (CH2M Hill, 1999) the Chemical Building foundation bears at approximate elevation 516 feet. Based on the design drawings for the Filter Building (Alfred LeFeber and Associates, 1953) the Filter Building basement foundations bear at approximate elevation 508 feet. We recommend that the excavations be temporarily sloped, braced or shored as needed to prevent movement of, or damage to, the surrounding ground, pavement, foundations, structures, utilities, etc.

New fills will be required for the proposed embankment to the north of the truck access drive, for re-filling the excavations made for the demolition of the existing clarifiers and tunnel, and for re-filling the recommended undercuts discussed in this paragraph. As mentioned in Section 6.1 of this report, both of the previously existing residences have been demolished. It is our understanding that the foundations associated with these residences have been removed and that the excavations were backfilled with a non-engineered, undocumented fill. We recommend that all remnants of the foundations, floors or other parts of the residences and all associated non-engineered backfill and other undocumented site fill should be undercut. After demolition of the existing clarifier/flocculator basins and the undercutting of the undocumented fill associated with the previous residences, fill amounts up to 14 feet or more will be required to reach the exterior finished grades. All equipment, foundations, slabs, pavements, walls, piping, etc. associated with the existing clarifier/flocculator basins and existing tunnel should be removed. All concrete, rubble, building material and debris associated therewith should be wasted off site.

Because portions of the site have been previously developed, unanticipated encumbrances, including but not limited to cisterns, leach lines, old foundations and floors, rubble, utilities or wells, could be encountered during the earthwork phase; particularly in the vicinity of the previously existing house and garage areas at the west side of GAC/PT Building and throughout the previous stockpile/waste fill area in and around the proposed GAC/PT Building. Our experience indicates that new pavements often perform poorly and exhibit cracking when constructed over old floor slabs, footings, or other structures. We recommend that demolition debris, foundations, floor slabs, etc. encountered during excavations at the site be removed prior to filling. Any noted encumbrances should be reviewed by the Engineer to develop recommendations for their remediation, and the Contract Documents should include an item for handling unanticipated encumbrances by the Contractor. In general, it is anticipated that such obstacles would be undercut, wasted off site and replaced with new compacted and tested fill.

All proposed cut, fill and development areas at the site should be cleared of all building debris and remnants of existing structures prior construction. Vegetation and the heavy root system (and all topsoil) should be stripped. The vegetation should be wasted off site. The asphalt and/or concrete pavement should similarly be stripped and wasted off site.

In addition to the demolition of the existing structures and undercutting of undocumented fill, this site will require undercutting due to the presence of existing low-strength, low-density fill soils, low-strength native cohesive soils, and building debris associated with the prior construction encountered in various areas across the project site. We recommend that all existing fill soils, all rubble and debris, and all soft to medium stiff native soils be undercut and removed from the proposed fill embankment area north and west of the west truck access drive and GAC/PT Building. If these low-strength soils, debris and fill are encountered within the limits of the other entrance drives or proposed parking areas at this site, they should be undercut to a depth of at least 4 feet below proposed pavement subgrade levels and replaced with compacted and tested cohesive soils. The undercuts beneath proposed pavements should be deep enough that at least 4 feet of stable compacted fill can be provided below pavement subgrade level. If the soils exposed at the bottom of the undercut are soft and unstable, it may be necessary to undercut an additional 1.5 to 2 feet to allow a thick bridge lift of fill to be placed as a working surface to achieve the upper 4 feet of stable compacted fill. We recommend that the Contract Documents include an item for undercutting of the existing low-strength, low-density fill materials and native soils, as deemed necessary, and their replacement with new compacted and tested fill on a per cubic yard of in-place compacted replacement fill basis.

We recommend that after stripping the proposed fill areas, and after completing the necessary undercuts, the exposed subgrades should be proofrolled utilizing a heavy piece of equipment under the review of the Project Geotechnical Engineer or his representative. If any soft or yielding soils are observed during the course of the proofrolling operations, these areas should be further undercut under the direction of the Project Geotechnical Engineer either to firm material or to a depth capable of bridging deep, unstable soils. In general, the surfaces of the proposed fill areas should be compacted to at least 95 percent of the maximum dry density per the standard Proctor moisture-density test, ASTM D698, prior to placing any fill.

We recommend that all new fill soils consist of on-site, clean, low-plasticity, cohesive soils relatively free of topsoil, vegetation, trash, construction or demolition debris, organic soils, frozen materials, particles more than 2 inches maximum dimension or other deleterious materials. The plasticity index of the fill soils should be 24 percent or less. New fills should be placed on the prepared surfaces in shallow horizontal layers, 6 to 8 inches in loose thickness. The fill should be compacted to at least 95 percent of the maximum dry density determined by the standard Proctor moisture-density test, ASTM D698, in parking lot, road and yard areas, and at least 98 percent beneath building areas. The moisture content of the fill at the time of compaction should be maintained within 2 percent below to 3 percent above the optimum moisture content. Fill on sloping terrain, such as for the embankment north and west of the west truck access road west of the GAC/PT building, should be placed and compacted on successive horizontal benches into stiff native soils that begin at the toe of the slope and continue upslope beneath the entire fill embankment. The horizontal benches should be cut at least 2 feet deep below the original, native ground surface, and deeper as necessary to satisfy the undercut and proofroll recommendations previously stated.

Regarding the GAC Feed Pump Station Building area, particular attention should be given to the placement and compaction of the fill and backfill in the demolished clarifier/flocculator areas and around the GAC Feed Pump Station wet well excavation, as this backfill will be the bearing material for new foundations of this building.

It is our opinion that the existing fill and native cohesive soils that have a plasticity index of 24 percent or less, and the bedrock, exclusive of the existing topsoil, organic soils, and highly plastic clays, should be suitable for reuse as new compacted and tested fill provided they are moisture conditioned to within the criteria listed above. There are some isolated areas where old demolition debris and possibly concrete rubble may be encountered at or near subgrade levels. This material should not be reused as new fill, and should be hauled off site and wasted. We expect there will be a moderate amount of limestone floaters within the existing fill that will be transported from cut to new fill areas. The limestone slabs should not be incorporated into the new compacted fill. Said limestone should be wasted offsite. It should be noted that the in-situ moisture contents of the existing fill will be above the optimum moisture content per ASTM D698 and that aerating and drying operations will most likely be required to achieve the specified degree of compaction. Additional time for the aerating and drying procedures should be considered in the construction sequencing, schedule and cost.

Groundwater may seep into the excavations and undercuts made for this project. The Contractor should be prepared to collect and dispose of the groundwater in order to maintain the excavations in a relatively dry condition prior to backfill operations. Groundwater seepage should be brought to the attention of the Engineer for evaluation of the need for dewatering and/or permanent drainage systems.

It is very important that good, positive drainage be established around the structures to promote the rapid drainage of surface water away from the buildings. Finish grading in grass or landscaped areas should be sloped down and away from the structure at 5 percent for at least 10 feet. All pavements should drain away from structures at a minimum of 2 percent.

We recommend that cut and fill slopes for this project remain not steeper than 3H:1V. Flatter slopes should be used whenever possible for increased stability and ease of maintenance. It is noted that the proposed fill embankment north and west of the west truck access drive will have a gradient of 3.5H:1V and that the proposed cut slope north of the GAC/PT Building will have a gradient of about 4H:1V. All fill slopes should be slightly overbuilt and then the face of the slope trimmed back so as to obtain a well-compacted surface. If topsoil is spread on completed cut or fill slopes, it should not be more than 6 inches thick and it should be tracked into place so as to minimize erosion and surface sloughing.

In regards to the finalized location of the detention pond, the existing ground surface slopes moderately to very gently downward to the north toward the Banklick Creek from the rear wall of the proposed GAC/PT building. The southern side of the proposed detention pond will be created by cutting a 4H:1V slope as much as 7 feet into the already sloping terrain. The historic test borings indicate that the ground surface, at the time of drilling, was underlain by topsoil and then 1.8 to 9.1 feet of fill followed by the native fluvio-lacustrine sedimentary soils and silty clay colluvial materials. It is anticipated that fill or the native sediment will be encountered in the excavations. Please refer to Section 10.4.3 for a discussion on slope stability of the cut slope and proposed detention pond. We also recommend that erosion protection be installed, as part of this project, in the highly eroded channel where the detention pond will outlet. It is our understanding that the erosion protection measures are being designed by others.

In regards to the existing slope north of the existing clarifier/flocculator basins, it is our opinion that equipment required for the demolition of the existing clarifier/flocculator basins and tunnel should remain on the south side of the excavations and that the northern slope in this area should not be surcharged with any additional fill or heavy equipment due to the history of instability and the steepness of the slope.

It is advisable that the earthwork operations at this site be carried out during the dry seasons of the year and that a sufficient gradient be maintained at the ground surface to prevent ponding of surface water. Experience has found that the optimum season of the year for earthwork in the Northern Kentucky Area is during the months of May through October because of the historically more favorable weather conditions during that period.

If any of the work is undertaken during the winter or early spring months, it is recommended that care be taken that no asphalt, concrete or fill is placed over frozen or saturated soils. Additionally, frozen or saturated soils should not be used as compacted fill or backfill.

10.4 Slope Stability

10.4.1 Slope to the North of the Existing Clarifier/Flocculator Basins

The slope north of the existing Chemical Building, Clarifier/Flocculation Basins and Filter Building extends from about 15 to 20 feet north of the Basins/Filter Building down to Banklick Creek about 230 horizontal feet and 60 vertical feet to the north. A documented landslide in 1975 required remediation measures including installation of drains to remove groundwater from the slope. The estimated headscarp of the previous landslide is shown on the Boring Plan, Drawing 081069E-100, in the Appendix to this report. Thelen personnel installed slope inclinometers in 1985 and 2001 to measure movements at the mid-point (I-1) and at the crest (ICM 101) of the slope. The most recent readings of the inclinometers were taken in December 2008. The readings at I-1 indicate that movement on the order of ¼ inch to the north (downslope) and east has occurred within the top 10 feet of material since 2001. Readings at ICM 101 indicate that movement has occurred since 2001 to the north and to the west of more than 1-inch and nearly 7/8-inch, respectively. Any significant movement has been restricted to the top 8 feet of depth from the ground surface. It is interpreted that movement since 2001 has been restricted to the relatively near surface materials, which is characteristic of a slope creep condition.

As previously noted, the existing Clarifier/Flocculation Basins will be demolished and the proposed GAC Feed Pump Station will now be built well away from the crest of the north slope within the footprint of the southern Clarifier/Flocculation Basin. The revised site plan indicates that an electrical substation will be constructed closest to the north crest of the slope, but still well away from the crest of the slope. Based on the loading information provided by GRW Engineers, Inc. and the fact that the Clarifier/Flocculation Basin will be demolished and backfilled to near existing grades, it is our opinion that the result will be a slight net unloading effect on the existing slope. Additionally, we recommend that the proposed grade to the north of the substation be reduced as much as practical to maintain or increase the stability of the north slope. A cross section of the slope with boring data from this subsurface exploration and previous Thelen projects in 1975 and 2001 is included as Cross Section A-A, Drawing 081069E-200.

It is understood that no heavy loading due to construction equipment will occur on the northern slope and that all construction and demolition equipment will access the area from the south. It is also understood that a temporary influent pipe must be installed in order to keep the existing plant in service during demolition of the existing Clarifier/Flocculator Basins and Tunnel. Based on discussions with the Design Engineer and our recommendations, it is our understanding that a temporary pipe will be attached above ground to the north wall of the existing north Clarifier/Flocculator Basin at the existing ground surface. Demolition of the existing facilities can then be accomplished, leaving a portion of the north wall where the pipe will be attached. As part of the demolition drawings, we recommend that a portion of the west and south walls remain and the existing floor remain in place in order to act as a counterfort and prevent overturning. We recommend that the Project Structural Engineer review the design drawings to determine the length of wall return, to determine if additional fill on the heel of the wall footing is necessary to prevent overturning of the wall, and to provide recommendations on the pipe bracing and supports. We also recommend that no spoils or surcharge of fill be placed north of the northern Clarifier/Flocculator.

10.4.2 Northwest Slope with Proposed Retaining Wall and Fill Embankment

We performed a stability analysis in order to develop recommendations for bearing support of the proposed Retaining Wall 'A' to be located along the western truck access drive. It is our understanding that two (2) types of construction are being considered for this retaining wall including a mechanically stabilized earth (MSE) wall and a reinforced concrete cantilevered retaining wall.

In addition, the stability analysis was performed to determine which of two optional detention pond locations was preferred from a hillside stability standpoint. As mentioned previously, two (2) locations were considered for the construction of the proposed detention pond. The originally planned location was on the northwest slope and the second location was to the north of the cut slope and north wall of the proposed GAC/PT Building.

Slope stability is typically quantified by a factor of safety. The factor of safety is a ratio of the resisting forces (shear strength) of the soils to the driving forces (primarily soil weight). If the factor of safety is 1.0, the resisting forces holding the hillside in place are equal to the driving forces, indicating a marginal state of stability. If the factor of safety is less than 1.0, the driving forces are greater than the resisting forces, indicating slope instability. If the factor of safety is greater than 1.0, the resisting forces are greater than the driving forces, indicating stability with varying risk of future instability depending upon the magnitude of the factor of safety. The generally accepted minimum factor of safety for slope stability under static (non-seismic) conditions is 1.5.

For analysis purposes, a cross-section was developed through the western truck access drive, proposed retaining wall and proposed fill embankment, through the location of the originally proposed detention pond, and continuing down to the south bank of the Banklick Creek. The static stability of the hillside was analyzed by assigning soil and groundwater conditions and weights and strengths to the soils in the subsurface profile based on experience and the results of the test borings. The cross section was analyzed to identify critical failure surfaces on the upper portion of the slope in the area of the retaining wall and the proposed fill embankment, near the proposed detention pond location, at the toe of the slope near the creek, and on the overall hillside. Rapid draw down was also considered near the base of the hillside toward the existing Banklick Creek.

When analyzing the lower portion of the cross-section, our stability analysis indicated that the current factor of safety against instability is below the target value of 1.5 near the originally planned detention pond and on the toe of the hillside near the creek when analyzing static stability and when considering rapid draw down of the creek. Based on these results, we recommended that the proposed detention pond should be constructed at the alternate location to the north of the proposed GAC/PT Building in order to remain further away from the creek and to promote long term stability of the detention pond.

The upper portion of the stability analysis cross-section, identified as Cross-Section B-B on Drawing 081069E-100 and shown on Drawing 081069E-300 in the Appendix, was analyzed in order to identify the critical failure surfaces for a factor of safety against instability of 1.3 and 1.5 in the vicinity of the proposed fill embankment and retaining wall. Those critical failure surfaces are shown on Drawing 081069E-300. The following recommendations are graphically presented and noted on Drawing 081069E-300:

- Geogrid lengths and the reinforced granular backfill zone for an MSE wall option should extend back to the factor of safety = 1.5 circle as shown on Drawing 081069E-300, but not less than the length required for internal and external stability of the MSE wall as designed by others.

- A concrete cantilevered retaining wall should bear at or below a depth such that the heel of the required footing extends to the factor of safety = 1.5 circle, but not less than 30 inches below final grades on the downslope side of the wall, as shown on Drawing 081069E-300.

<u>10.4.3 Proposed Cut Slope and Detention Pond to the North of the Proposed GAC/PT Building</u>

After determining that the alternate location of the detention pond was preferred from a long-term stability standpoint, we reviewed the proposed grading of the cut slope and detention pond to the north of the proposed GAC/PT building and made recommendations regarding the gradients of the cut slope and the side slopes for the detention pond. The proposed cut slope and detention pond is shown on Cross Section C-C on Drawing 081069E-400 in the Appendix to this report. Our recommended grading is also shown on this drawing and includes a 4H:1V cut slope down to the base elevation of the proposed detention pond, 3H:1V interior side slopes and a 2.76H:1V north exterior slope to avoid filling in the 100 year flood plain. If a small amount of fill in the flood plain is permissible, the north exterior slope should also be made 3H:1V.

10.5 Foundation Recommendations

10.5.1 Proposed GAC/PT Building Foundations

In our opinion, the existing fill and the underlying variable native overburden soils encountered beneath the ground surface at the proposed GAC/PT Building location are not suitable for supporting the proposed structure on shallow foundations without risk of damaging differential settlements. A deep foundation system is recommended to support the proposed building on bedrock. All primary column, wall, and/or slab foundations, and all floors should be supported on deep foundations. We have included recommendations for conventional reinforced concrete drilled shafts. A grid pattern of drilled shafts should be constructed for the support of the structural floor slabs, load bearing columns, and/or the building walls. The allowable axial loads presented in the following sections were estimated using bedrock sockets ranging from 1 to 3 feet.

10.5.1.1 Drilled Shafts

The test borings indicate that the overburden at the proposed GAC/PT Building consists of poor quality fill material of varying thickness overlying sedimentary and colluvial soils and bedrock. We recommend that the foundations consist of reinforced concrete drilled shafts. A drilled shaft is a deep foundation that is constructed by placing concrete in a drilled hole. Reinforcing steel can be installed in the excavation, if desired, prior to placing the concrete. Drilled shafts are commonly constructed by employing rotary drilling equipment to bore a cylindrical hole. The borehole may remain unsupported in soils with cohesion or in bedrock, or it may be kept open by using drilling slurry or casing in granular soils. If used, the casing is typically temporary.

The drilled shafts should extend through all existing fill, native overburden soils, and the highly weathered and weathered shale and limestone bedrock. The shafts should be socketed at least 12 inches into the unweathered gray shale and limestone bedrock and be proportioned for a maximum allowable bearing pressure of 30,000 pounds per square foot (psf), full dead and full live loads, exclusive of the weight of the shaft. Drilled shafts socketed at least 36 inches into the unweathered bedrock can be proportioned for a maximum allowable bearing pressure of 60,000 psf, full dead and full live loads, exclusive of the weight of the shaft. Estimated shaft tip elevations at test borings drilled specifically for this project within or near the proposed GAC/PT Building footprint are shown in Table 2.

Table 2. Estimated Shaft Bearing Elevations

Test Boring	Ground Surface Elevation (Feet, MSL)	Top of Unweathered Bedrock Elevation (Feet, MSL)	Estimated Bearing Elevation (Feet, MSL)	
			1' Rock Socket	3' Rock Socket
GAC-101	517.4	479.4	478.4	476.4
GAC-102	521.0	478.0	477.0	475.0
GAC1	525.8	491.8	490.8	488.8
GAC2	521.6	478.6	477.6	475.6
GAC3	525.9	492.9	491.9	489.9
GAC4	531.9	503.9	502.9	500.9
GAC5	529.9	496.9	495.9	493.9

All elevations shown are in feet above MSL. It should be noted that these elevations should be used for estimating purposes only and that the final bearing conditions for the shafts should be field verified. The specifications should require verification of the penetration into unweathered bedrock at each shaft. The shafts should be installed at spacings not less than 3 shaft diameters, center to center. Reduction of the recommended axial compression load is not necessary for shaft groups provided that the recommended minimum spacing is maintained.

10.5.1.2 Materials

Concrete with a minimum 28-day compressive strength of 4,000 psi should be used in the construction of the shafts. The concrete should also exhibit good workability. The clear spacing between bars of the rebar cage should be at least five times the size of the maximum coarse aggregate used in the concrete mix. Hooks at the top of the rebar cage should not be bent outward if there is any chance that temporary casing will be used. Interior hooks should be designed to permit adequate clearance for a concrete tremmie pipe, if needed. The outside diameter of the assembled rebar cage should be at least six inches smaller than the drilled hole diameter.

10.5.1.3 Construction Methods and Equipment

Excavation to footing elevation should be completed before shaft construction begins unless otherwise noted in the Contract Documents or approved by the Engineer. Any disturbance to the footing area caused by shaft installation should be repaired by the Contractor prior to the footing concrete placement.

When drilled shafts are to be installed in proposed fill areas, the Contractor should construct drilled shafts after the placement of the fill unless shown otherwise in the Contract Documents or approved by the Engineer.

The excavation and drilling equipment should have adequate capacity, including power, torque and down thrust, to excavate a hole of both the maximum diameter and to a depth of 20 percent beyond the depths shown on the plans. The excavation tools should be of adequate design, size and strength to perform the work shown in the project plans or described herein. When the material encountered cannot be drilled using conventional earth augers with soil or rock teeth, drill buckets, and/or grooving tools, the Contractor should provide special drilling equipment, including but not limited to: rock core barrels, rock tools, air tools, and other equipment as necessary to construct the shaft excavation to the size and depth required.

Shaft excavations should be made straight and plumb at the locations and to the estimated bottom of shaft elevations, shaft geometry and dimensions shown in the Contract Documents. The Contractor should extend drilled shaft tip (base) elevations if the Engineer determines that the material encountered at the design base elevation is unsuitable and/or differs from that anticipated in the design of the drilled shaft.

The Contractor should maintain a construction method log during shaft excavation. The log should contain information such as: the description and approximate top and bottom elevation of each soil or rock material encountered, seepage or ground water, and remarks, including a description of the tools and drill rigs used and any changes necessitated by changing ground conditions.

The Contractor should not permit workers to enter the shaft excavation for any reason unless: both a suitable casing has been installed and the water level has been lowered and stabilized below the level to be occupied, and adequate safety equipment and procedures have been provided to workers entering the excavation.

Surface and subsurface obstructions at drilled shaft locations should be removed by the Contractor. Such obstructions may include man-made materials such as old concrete foundations and natural materials such as boulders. Special procedures and/or tools should be employed by the Contractor after the hole cannot be advanced using conventional augers and/or drilling buckets. Such special procedures/tools may include, but are not limited to: chisels, boulder breakers, core barrels, air tools, hand excavation, temporary casing, and increasing the hole diameter. Blasting should not be permitted unless specifically approved in writing by the Engineer.

Drilling tools that are lost in the excavation should not be considered obstructions and should be promptly removed by the Contractor without compensation. All costs due to lost tool removal should be borne by the Contractor including, but not limited to, costs associated with repair of hole degradation due to removal operations or an excessive time that the hole remains open.

It is anticipated that most of the shaft excavations can be completed without the need for casing to control caving or groundwater. However, we recommend that the Contract Documents include an item for casing on a per-cased-shaft basis, and be used only as needed, and as determined by the Engineer. Casings should be steel, smooth, clean, watertight, and of ample strength to withstand both handling and driving stresses and the pressure of both concrete and the surrounding earth and water. The outside diameter of casing should not be less than the specified diameter of the shaft, and the outside diameter of any excavation made below the casing should not be less than the specified diameter of the shaft. No extra compensation should be allowed for concrete required to fill an oversized casing or oversized excavation.

All casings should be considered temporary and removed from shaft excavations. The Contractor should be required to remove temporary casing as the concreting of the drilled shaft is completed. If the Contractor elects to remove a casing and substitute a longer or larger-diameter casing through caving soils, the excavation should be either stabilized with slurry or backfilled before the new casing is installed. Other methods, as approved by the Engineer, may be used to control the stability of the excavation and protect the integrity of the foundation materials.

Before the casing is withdrawn, the level of fresh concrete in the casing should be a minimum of 5 feet above the hydrostatic water level in the formation. As the casing is withdrawn, care should be exercised to maintain an adequate level of concrete within the casing so that fluid trapped behind the casing is displaced upward and discharged at the ground surface without contaminating or displacing the shaft concrete.

Grade beams or turned-down structural slab edges between exterior shafts should be at least thirty (30) inches below final exterior grades for frost protection.

The Contractor should provide equipment for checking the dimensions and alignment of each shaft excavation. The dimensions and alignment should be determined by the Contractor under the direction of the Engineer. Final shaft depths should be measured with a suitable weighted tape or other approved methods after final cleaning. All loose, soft, wet or otherwise unsuitable materials should be removed from the bearing surface before shaft reinforcing steel or concrete is placed. The Engineer or his representative should determine shaft cleanliness by visual inspection. In addition, the maximum depth of water in the bottom of the excavation should not exceed 4 inches prior to concrete placement. The sidewalls should be visually free of cuttings that may have been smeared on the walls during the removal and insertion of drilling tools.

The reinforcing steel cage, consisting of longitudinal bars, ties, cage stiffener bars, spacers, centralizers, and other necessary appurtenances, should be completely assembled and placed as a unit immediately after the shaft excavation is inspected and accepted, and prior to concrete placement. Internal stiffeners should be removed as the cage is placed in the borehole so as not to interfere with the placement of concrete.

Concrete should be placed as soon as possible after reinforcing steel placement. Concrete should be placed either by free-fall methods in dry excavation shafts, or by tremmie methods in slurry-stabilized excavations. The top 10 feet of shaft concrete should be consolidated with a vibrator.

If, during construction, the bearing elevation of a shaft is to differ from the plan elevations presented in the construction drawings by more than one foot, the Engineer should be contacted for approval prior to installation of any reinforcing steel or concrete in the shaft excavation.

10.5.2 Proposed GAC Feed Pump Station

The test borings in the vicinity of the proposed GAC Feed Pump Station indicate that medium stiff to very stiff native clay soils are present at and below the wet well subgrade elevation of 506.5 feet. It is understood that the excavation for the wet well will be backfilled with compacted and tested backfill for bearing support of the upper, remaining portions of the GAC Feed Pump Station Building. Therefore, we recommend the use of structural mat foundations bearing in stiff native clays for the GAC Feed Pump Station wet well, and shallow spread footings for the remaining portions of the building bearing within the compacted and tested backfill.

The location of the GAC Feed Pump Station is underlain by medium stiff to stiff fill and/or medium stiff to very stiff native silty clays and clays, and then the interbedded shale and limestone bedrock. Overburden depths vary from about 34 to 47 feet below the bearing elevation of the wet well (about elevation 506.5 feet). It is expected that medium stiff to stiff native silty clay soils will be exposed by the removal of existing foundations and excavations to the proposed subgrade elevation of 506.5 feet. If soft, undesirable soils are encountered at the bearing levels, we recommend undercutting those soils to expose stiff undisturbed native clay soils, and replacing those soils with low-plasticity clay structural fill as described in Section 10.3 of this report. Alternately, the undercuts could be filled with lean concrete exhibiting a 28-day compressive strength of 1,500 pounds per square inch (psi). After the removal and replacement of any undesirable soils at the bearing levels, it is our opinion that the exposed medium stiff to stiff silty clays and any compacted and tested structural fill will be suitable for supporting the structure on a mat foundation designed for a maximum gross allowable bearing pressure of 2,500 psf at the proposed foundation bearing levels. It should be noted by the Designer that the lateral design pressure on the wet well walls should include an appropriate surcharge from the foundations of the upper, adjacent, at-grade portion of the GAC Feed Pump Station Building.

In regards to the remaining at grade portion of the GAC Feed Pump Station Building, it is our opinion that this portion of the building may be supported on conventional shallow spread footings bearing in the compacted and tested backfill. The footings can be proportioned based on an allowable bearing pressure of 3,000 psf, full dead and full live loads.

We recommend that continuous wall footings have a width of no less of 18 inches and that isolated column footings be at least 2 feet square. All exterior footing bottoms should be placed at least 30 inches below proposed finished exterior grades, the accepted depth for frost protection in the Northern Kentucky Area.

It is recommended that the bottoms of all footings not be supported higher than a relationship of 2H:1V upward from the invert of any paralleling or nearly paralleling proposed or existing utility trenches. We recommend that, if required, footings steps be a maximum height of 2 feet with a corresponding minimum length of 4 feet. Reinforcing steel and concrete should be continuous through the footing steps.

We recommend that the footing excavations be made to neat lines and grades so that concrete can be placed against the banks of excavations without forming. We recommend that efforts be made so that the natural moisture contents of the bearing surfaces are maintained both during and after construction. Moisture contents may most effectively be controlled by the placement of footing and floor slab concrete as soon as possible after bearing surfaces and subgrade preparation.

It is also important that good surface drainage be maintained during and after construction to prevent water from ponding in and around footing excavations and on the floor slab subgrades. Footing concrete should be placed in footing excavations the same day that the footing excavations are made and prepared. Loose soil, debris, water, and/or soils disturbed by excavation or exposure should be removed from the bearing surfaces prior to concrete placement.

It is recommended that all footing excavations be reviewed by our Project Geotechnical Engineer or his/her representative prior to placing concrete to determine that bearing materials and surfaces are consistent with the recommendations contained herein.

In regards to the different bearing elevations of the building, it is noted that a portion of the GAC Feed Pump Station Building will be supported on the wet well structure bearing on stiff native soils, while compacted and tested backfill will support the remaining, upper portion of the building. There will be some potential for differential settlement between the deep wet well and shallow foundation parts of this structure. Therefore, we recommend that the Designer include control joints in the building superstructure and reinforce the foundation connection between the two parts to reduce the effects of potential differential settlements between the different portions of the building.

The prepared subgrade bearing surface for the wet well excavation should be covered with a thin concrete 'mud mat' to protect the surfaces from excessive wetting, drying or disturbance related to construction. Prior to placing the concrete 'mud mat', reinforcing steel, or foundation concrete, the bearing surfaces should be cleaned of all loose, wet, soft, or otherwise disturbed material.

10.5.3 Substation and Generator Pads

It is our understanding that the proposed substation and generators will be supported by slabs on grade. These pads will be constructed on the compacted and tested backfill associated with the demolition of the existing Clarifier/Flocculator Basins and the existing tunnel. It should be noted that slabs on grade tend to experience seasonal frost movements if the slabs do not bear at frost penetration depths. If the proposed electrical equipment cannot accept the seasonal frost movements of the proposed slabs on grade, we recommend that these pads bear at the normal frost penetration depth of at least 30 inches. It is our opinion that the compacted and tested fill is suitable for bearing support and that the pads may be proportioned for an allowable bearing pressure of 3,000 psf, full dead and full live load.

10.6 Floor Slabs

In regards to the slabs on grades, where the floor will not be supported by drilled shafts, it is our opinion that the newly placed compacted and tested backfill from the demolition excavations will be suitable to support the proposed slabs on grade for the substation, generator pads and the at grade portion of the GAC Feed Pump Station Building.

The exposed soil subgrade in the slab areas should be proofrolled utilizing a heavily loaded piece of equipment under the review of the Project Geotechnical Engineer or his/her representative as part of the final slab subgrade preparation. Should any soft or yielding materials be observed during the course of the proofrolling operations, we recommend that they be undercut to firm material at the direction of the Engineer.

After proofrolling operations, any fill required to achieve the proposed slab subgrade levels should be constructed with approved on-site lean clayey soils or approved borrow compacted to not less than 95 percent of the standard Proctor maximum dry density, ASTM D698. The moisture content should be between 2 percent below and 3 percent above optimum moisture content (ASTM D698) at the time of compaction of the cohesive fill. Any granular base used below the floor slabs should be compacted to at least 75 percent relative density, ASTM D4253 and D4254.

It is recommended that control joints be provided within concrete slabs-on-grade. Said joints should be sealed as soon as practical to mitigate surface water infiltration. It is recommended that the floor slabs-on-grade of the proposed GAC Feed Pump Station Building be made structurally separate from all columns, walls, foundations and plumbing. We recommend that bond breakers be utilized between slabs and the perimeter foundation walls, between the slabs and columns, and between the slabs and plumbing risers.

We also recommend that a granular blanket consisting of at least 4 inches of free-draining gravel be used beneath the floor slabs-on-grade, which will permit breathing so that some aeration below the slab can take place. It is recommended, however, that care be implemented during installation of the granular blankets so that it will not become saturated with infiltrating water during or after construction.

10.7 Retaining Walls

As indicated previously, three (3) retaining walls are planned in the GAC/PT Building area. Retaining Wall 'A' will be located along the north/west shoulder of the truck access drive on the west side of the proposed building. The height of this wall will range from about 6 to 10 feet. The proposed finished grade of the truck access drive will transition from 524.0 feet at the west edge of the building, down to a low spot at El. 523.0 feet where a storm sewer will be installed and then back up to El. 530.0 feet at Grand Avenue. Retaining Wall 'B' will be located along the north edge of the eastern parking lot and will have a maximum height of about 3.5 feet. Retaining Wall 'C' will be located near the southeast corner of the proposed GAC/PT Building, along the administrative area, and will have a maximum height of about 5 feet.

Retaining Wall 'A' will be constructed over newly placed compacted and tested fill or stiff to very stiff native silty clays. Based on discussions with the Design Team, it is our understanding that the proposed wall construction will consist of a concrete cantilevered retaining wall or a mechanically stabilized earth (MSE) geogrid reinforced wall. Due to stability concerns with the existing hillside and proposed fill embankment, we have made specific recommendations about bearing depths for a concrete cantilevered retaining wall and geogrid lengths for an MSE wall. Please refer to Section 10.4 of this report for those specific recommendations. An allowable bearing pressure of 3,000 psf may be used in design of either wall option. Lateral earth pressures and drainage systems to be used in the design of Retaining Wall "A" should be selected by the Professional Engineer designing the wall after the wall type (reinforced concrete on MSE) is selected. Appropriate vehicle surcharge loads should also be considered in the design of this wall. We are available to consult with the Designer about the selected design parameters after the wall type is selected.

Retaining Walls 'B' and 'C' will be constructed over poor quality, existing fill and native overburden soils of variable stiffness and depths. It is anticipated that the weight of these walls and the new fill soils that they retain will cause consolidation in the existing poor quality fill soils or medium stiff native overburden soils, and the walls may settle as much as an inch or more. In our opinion, if these walls are built as reinforced concrete walls, and if the estimated settlements are intolerable, then the walls should be supported on drilled shafts to bedrock, or the existing fill be undercut and replaced with well-compacted structural fill. An alternative would be to construct the walls as flexible segmental block walls with geogrid reinforcement and accept the anticipated settlements.

Based on discussions with the Design Team, it was decided that the proposed Retaining Walls 'B' and 'C' would be constructed as MSE (geogrid reinforced) segmental structures. These walls typically consist of concrete block units with integral geogrid reinforcement and compacted granular fill in the geogrid reinforced zone. The combination of these elements creates a reinforced soil mass forming a relatively large gravity wall structure. Because of their flexible nature, it is our opinion that these walls will be able to tolerate the settlements of the old and new fills and/or native soils that will support the walls at normal frost penetration depth. An allowable bearing capacity of 1,000 psf may be used in the design of these walls. Appropriate vehicle surcharge loads should be considered in the design of the walls.

10.7.1 General MSE Wall Recommendations

Based on the preferred type of concrete block units placed on the face of the walls, a number of reinforced retaining wall systems are available. The concrete blocks are typically about 6 to 12 inches in height, 10 to 18 inches wide, and about 12 to 24 inches deep. We recommend that the design of the mechanically stabilized walls be performed by a Professional Geotechnical Engineer.

We recommend a full-height drainage fill for a minimum distance of 1 foot behind the segmental wall facing units. The select drainage fill material should be clean, well-graded crushed stone or crushed gravel with GW classification per the Unified Soil Classification System. The maximum particle size should be 0.75 inch and the portion passing the US Standard Sieve No. 200 should be less than 3 percent. We also recommend that a select granular fill material consisting of sands as approved by the Project Geotechnical Engineer be used in the geogrid-reinforced section of the walls. The following design parameters may be used in the design of the reinforced earth retaining structure.

Soil Type	**Effective Angle of Internal Friction (degrees)**	**Moist Unit Weight (pcf)**	**Effective Cohesion (psf)**
Granular Backfill	35	120	--

The subject geogrid-reinforced wall should be designed in accordance with the criteria set by the design manual for segmental retaining walls, prepared by the National Concrete Masonry Association (NCMA).

We recommend that only granular soils as indicated above be considered for fill material in the geogrid-reinforced zone of the subject walls. For the retained cohesive soils outside the reinforced zone of the walls, the following design parameters may be used.

Soil Type	Effective Angle of Internal Friction (degrees)	Moist Unit Weight (pcf)	Effective Cohesion (psf)
Compacted cohesive fills or stiff undisturbed on-site soils	24	127	0

We recommend that the design and construction plans of the mechanically stabilized wall be reviewed by the Project Geotechnical Engineer prior to proceeding with construction.

10.8 Lateral Earth Pressures

The below-grade structure and retaining walls should be designed for at-rest lateral earth pressures and any applicable ground surface surcharges. The magnitude of the lateral earth and water pressures will depend on the type of backfill material, and whether or not a drainage system with a permanent drainage outlet is provided around the below-grade portions of the structures.

The lowest design lateral pressures will result if a drainage system is provided around the structures. If a drainage system is utilized, the system should consist of a minimum 12-inch wide zone of free-draining granular backfill with less than three (3) percent particle sizes passing the No. 200 sieve. The free-draining granular backfill should be compacted to a relative density of at least 75 percent (ASTM D4253 and D4254). The free-draining granular backfill should be separated from the native soils and backfill with a non-woven geotextile filter fabric, such as Mirafi 140N, specifically designed for filtration. The drainage system should have a perforated drainpipe with a permanent outlet.

The recommended design lateral earth pressures depend on whether or not a drainage system is provided. If a drainage system is provided, we recommend using an Equivalent Fluid Weight (EFW) of 75 pounds per cubic foot (pcf) from the ground surface down to the bottom of the drainage system. From the bottom of the drainage system to the bottom of the foundation, it is recommended that water pressures be included for design of the structure's walls. Taking into consideration the subsurface conditions and assumed undrained groundwater conditions, we recommend that the below-grade walls be designed using an EFW of 100 pcf from the bottom of the drainage system to the bottom of the foundation. Similarly, we recommend that below-grade walls with no drainage system be designed using an EFW of 100 pcf from the ground surface down to the bottom of the foundation.

10.9 Buoyancy

The below-grade structures will experience buoyant (uplift) forces due to high groundwater levels if a drainage system is not provided. For design against uplift in an undrained condition, it is recommended that the water level be assumed at the final ground surface around the structure, which will give the maximum uplift force when the structure is empty, or to the bottom of the drainage system if a drainage system is provided. The resistance to uplift should be provided by a combination of the dead weight of the structure, dead weight of any soil backfill atop foundation projections beyond the structure walls, frictional resistance/adhesion around the perimeter of the structure and uplift resistance of the drilled shaft foundations.

The dead weight of soil backfill atop foundation projections should be calculated using a buoyant unit weight of soil of 57.6 pcf below the level at which a backfill drainage system is provided. Above the backfill drainage level, a moist unit weight of 120 pcf can be used. The frictional resistance/adhesion around the perimeter of the structure is dependent upon many factors that are unknown at this time, such as the type of backfill materials that will be used and their degree of compaction. The most conservative combination of these factors may result in an ultimate friction factor of about 0.3 for the drainage backfill if a drainage system is provided, and an ultimate adhesion of 500 psf for the clayey soil backfill. The design ultimate friction factor/adhesion value should be confirmed after the above unknowns are specified by the design.

The Geotechnical Engineer should be contacted if uplift resistance of drilled shaft foundations is required.

10.10 Pavements

Pavements for this project should be designed in accordance with expected axle loads, frequency of loading and the properties of the subgrade. The subgrade properties should be evaluated by field CBR or plate load tests after final grading is completed or by the correlation of field density tests to laboratory CBR tests. In each case, we recommend that the upper 8 inches of subgrade be compacted within 2 percent of optimum moisture content to at least 100 percent of maximum density as determined by the standard Proctor moisture-density test, ASTM D698.

We recommend that if a dumpster will be used at the project site, the dumpster should be supported on a concrete slab and the slab should be sized to accommodate the loading wheels of the dumpster truck. In addition, pavements servicing dumpsters should be designed for the heavier loads associated with the dumpster trucks.

10.11 Pipelines

The proposed pipelines that will be constructed to service the proposed GAC Advanced Treatment Facilities at the project site are described in Section 2.4 of this report and are shown on our Revised Boring Plan, Drawing 081069E-100 in the Appendix to this report. As previously mentioned, it is our understanding that all of the pipe will be internally restrained due to the proximity of these lines to other existing and proposed utilities, as well as existing and proposed structures and foundations. The restrained joint pipe systems will serve three (3) purposes: 1) to resist damage due to possible ground movements of the sloping terrain; 2) to eliminate the need for thrust blocks that would be required due to the forces at the pipe bend locations from water pressure on the inner pipe applied to the outer parallel pipe; and 3) distribute any concentrated loads from water pressure forces at pipe bend locations.

The anticipated conditions along each pipeline are as follows:

- 24-Inch Raw Water Main – The proposed pipe invert will range from about Elevation 516 to 520 feet (El. 516 to 520). Test Borings GAC105, GAC4, 108 (970209E) and 12 (050386E) are closest to this proposed pipe alignment. The test borings indicate that topsoil fill, the native colluviums or the native fluvio-lacustrine sedimentary soils will be encountered to those invert levels.

- 24-Inch GAC Supply Line – The proposed pipe invert will range from about El. 516 to 519 feet. Test Borings GAC5, 2 (87189) and SED1 are closest to the proposed alignment. The test borings indicate that fill and native fluvio-lacustrine sedimentary soils will be encountered to those invert levels.

- 24-Inch GAC/UV Treated Water Line – The proposed pipe invert will range from about El. 519 feet at the proposed GAC/PT Building to about El. 512 feet at the existing Filter Building. A portion of this alignment will run parallel to and about 7 feet east of the east wall of the existing Chemical Building, which bears at El. 516 feet. The excavation for this trench will encroach upon the recommended 2H:1V relationship between the bearing level of the Chemical Building and the bottom of the trench excavation. Test Borings GAC5, 101 and 109 (970209E), SED3 and 2 (86079E) are closest to this alignment. These test borings indicate that fill, native colluviums and/or native fluvio-lacustrine soils will be encountered to those invert levels.

- 42-Inch Filter Influent Pipe – The proposed pipe invert level will range from about El. 508.5 feet at the proposed GAC/PT Building to about El. 525 feet at the existing Filter Building. Test Borings 111 (970209E), 7 (050386E), 109 (970209E), 8 (87189E) and GAC8 are closest to this alignment. These test borings indicate that topsoil, fill and/or native fluvio-lacustrine soils will be encountered to those invert levels. A portion of this alignment will run parallel to and about 14 feet west of the west wall of the Chemical Building, which bears at El. 516 feet. This parallel portion will have an invert of about El. 512.5 feet, having a relationship of greater than 2H:1V from the bearing level of the Chemical Building.

- 24-Inch Temporary Filter Influent Pipe – This pipe will be near the existing ground surface as discussed in detail earlier in this report.

- 24-Inch GAC Feed Pump Station Supply Line – The proposed invert level will range from about El. 509 feet at the GAC Feed Pump Station to about El. 515 feet at the Filter Building. Test Borings SED3 and 2 (86079E) are closest to this alignment. The test borings indicate that native fluvio-lacustrine soils will be encountered to those invert levels. Based on the proposed finished floor of El. 524 feet and the proposed invert levels, the trench excavations for this pipe will have a relationship of less than 2H:1V where the alignment is paralleling the proposed GAC Feed Pump Station. Unless construction can be staged so that the trench excavations do not undermine the footing of the proposed GAC Feed Pump Station, we recommend that this excavation be shored during construction.

- 24-Inch GAC Feed Pump Station Overflow – The proposed invert level for this alignment will be about El. 516.5 feet at the proposed GAC Feed Pump Station until the crest of the fill embankment where the pipe will outlet into the existing eroded channel to the northeast of the proposed detention pond at about El. 485.5 feet. The portions of the alignment that run parallel to the existing Chemical Building will not be within the influence of the bearing for the Chemical Building. Test Borings SED3, 102 (970209E), GAC8 and 6 (050386E) are closest to this alignment. These test borings indicate that fill and/or native fluvio-lacustrine soils will be encountered to the proposed invert levels.

- 54-Inch Chemical Feed Trench – A profile of this alignment was not completed as of the date of this report. The detail on the Project Plan indicates that the trench will be a pre-cast concrete structure that is 32.5 inches tall. The proposed GAC/PT building will bear on deep foundations in the rock so depth of this feed trench is not critical with respect to bearing influence of this building. However, a portion of the feed trench is shown parallel and close to the west wall of the Chemical Building. We recommend that a 2H:1V relationship be maintained between the invert level of the Feed Trench and the bearing elevation of about 516 feet of the existing Chemical Building.

We recommend that the GAC Feed Pump Station Overflow pipe and the overflow pipe to the same swale from the GAC/PT Building be constructed using gasketed, waterproof joints to reduce the possible water loss into the surrounding soils on the slope north of the existing Chemical Building and north of the GAC/PT Building. Additionally, we recommend that the overflow pipes be bedded on, and the trench backfilled with, clean, free-draining gravel from the points where they exit the Buildings to the headwalls where they enter the drainage swale. Backfill above the gravel should be compacted clay. A minimum ten (10) foot length of perforated pipe should be placed at the bottom of each pipe trench terminus and connected to an outlet in the headwall face. This gravel backfill and outlet pipe will allow any water seepage in the trench to be drained rather than penetrate into the slope soils.

It is noted that there are portions of the proposed pipelines that will run parallel with sections of the existing Chemical and Filter Building walls. We recommend that the locations and elevations of all pipes and other utilities for this project be designed such that the relationship between the bottoms of the trenches for the pipes/utilities and all existing and proposed foundations be 2 horizontal to 1 vertical, or flatter. Wherever this relationship cannot be maintained, an approved shoring system should be installed to provide support to adjacent structures and infrastructure during the installation of the pipes, and the specified degree of compaction of the trench backfill should be increased to 98 percent, ASTM D698.

The excavations for all utility/pipe trenches must be made in a manner that provides for the safety of workers in the excavations and protects existing ground, structures, and infrastructure adjacent to the excavations from damage. The excavations should be braced, shored, sloped, or otherwise stabilized in a manner that satisfies all safety concerns and all federal, state, and local regulations. The responsibility of maintaining safe working conditions in the excavations and for protecting ground, structures, and infrastructure adjacent to the excavations should be the Contractor's.

Normal and recommended utility construction practice is to bed and backfill pipes with granular fill to 6-inches above the crown of the pipe, and then complete the backfilling up to ground surface with well-compacted clay soils. Compaction of trench backfill to a moist, firm, dense condition is important for all pipelines. We recommend that all pipeline backfill for this project be placed in shallow level layers, 6 to 8 inches in thickness, and compacted to densities not less than 95 percent of the standard Proctor maximum dry density, ASTM D698. We recommend that pipe trench granular backfill be limited to pipe bedding and to 6-inches above the pipe. All granular backfill should be compacted to at least 75 percent relative density, per ASTM D4253 and D4254.

The Contractor also should be responsible for maintaining the stability of all existing utilities during the installation of utility/pipe lines. This includes, but is not limited to, the 12-inch diameter storm sewer north of the exiting Chemical Building, as well as the 8-inch diameter sanitary sewer, 15-inch diameter storm sewer, and 36-inch diameter water lines west of the existing Chemical Building. The storm sewer and other utilities must be protected, braced, supported, and maintained in service during construction of these pipelines, and must be re-supported with compacted bedding and backfill as the work is completed.

10.12 Tunnel Structure

As previously noted, the existing Tunnel Structure will be completely demolished. The Tunnel Structure demolition will allow access to the area occupied by the existing north Clarifier/Flocculation Basin for demolition and construction activities. The structural fill and backfill of this excavation should conform to the recommendations in Section 10.3 of the report.

11.0 CLOSURE

The conclusions and recommendations of this report have been derived by relating the general principles of the discipline of Geotechnical Engineering to the proposed construction outlined by the Project Characteristics section of this report. Because changes in surface, subsurface, climatic, and economic conditions can occur with time and location, we recommend for our mutual interest that the use of this report be restricted to this specific project.

Our understanding of the proposed design and construction is based on the documents and information provided to us at the time this report was prepared and which are referenced in the Project Description section of this report. Any changes or modifications which are made in the field during the construction phase which alter site grading, structure locations, infrastructure or other related site work should also be reviewed by a qualified Geotechnical Engineer prior to their implementation.

Recommendations have been provided in the various sections of this report. The report shall, therefore, be used in its entirety. The Designer should see that all parties have the entire report with all possible supplementary information for their respective use and that they understand the intent of the contents. This report is not a bidding document and shall not be used for that purpose. Anyone reviewing this report must interpret and draw conclusions regarding specific construction techniques and methods each chooses to use.

APPENDIX

ASFE Report Information

Tabulation of Laboratory Tests

Unconfined Compressive Strength Test Forms - Soil

Unconfined Compressive Strength Test Forms - Rock

Consolidation Test Forms

Moisture-Density Test Form

Test Boring Logs, 081069E

Test Boring Logs, 75126E, 86079E, 87189E, 90044E, 970209E, 010563E, 010777E, 050270E, 050386E and 060581E

Soil Classification Sheet

Rock Weathering and Strength Classification Sheet

Cross Section B-B, Drawing 081069E-300

Cross Section C-C, Drawing 081069E-400

Revised Boring Plan, Drawing 081069E-100 (In Pocket)

Cross Section A-A, Drawing 081069E-200 (In Pocket)

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TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft. From	Depth, ft. To	Moisture Content, %	Atterberg Limits, % LL	PL	PI	Standard Proctor Maximum Dry Density, pcf	Standard Proctor Optimum Moisture Content, %	Natural Dry Density, pcf	Unconfi Compres Streng psf
GAC-101	1B	0.4	1.5	23.9							
	2	2.5	4.0	20.2							
	3	5.0	6.5	21.1							
	4	7.5	9.0	24.5							
	5	10.0	11.5	23.8	31	21	10				
	6	12.5	14.0	20.8							
	7	15.0	16.5	20.7							
	8	17.5	19.0	20.8							
	9	20.0	21.5	25.2							
	10	22.5	24.0	27.5							
	11	25.0	26.5	16.3							
	12	30.0	31.5	21.5							
	13	35.0	36.5	11.6							
	14	40.0	40.7	9.3							
	15	45.0	45.5	12.0							
GAC-102	1	0.0	1.5	18.3							
	2	2.5	4.0	13.2							
	3	5.0	6.5	23.4	38	22	16				
	4A	7.5	8.0	22.0							
	4C	8.5	9.0	23.2							
	5	10.0	11.5	22.6							
	6	12.5	14.0	20.7							
	7	15.0	16.5	22.4							
	8	17.5	19.0	20.1							
	9	20.0	21.5	25.3	31	19	12				
	10	22.5	24.0	24.5							
	11	25.0	26.5	24.3							
	12	30.0	31.5	24.1							

TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft.		Moisture Content, %	Atterberg Limits, %			Standard Proctor		Natural Dry Density, pcf	Unconfi Compres Streng
		From	To		LL	PL	PI	Maximum Dry Density, pcf	Optimum Moisture Content, %		psf
GAC-102	13	35.0	36.5	25.6	56	26	30				
	14A	40.0	40.5	24.2							
	14B	40.5	41.5	14.7							
	15	45.0	45.5	9.6							
	16	50.0	50.5	8.6							
GAC-103	PT-2	2.5	3.0	23.1						103.9	2960
	3	3.5	5.0	20.3							
	4	5.0	6.5	21.7							
	5	7.5	9.0	18.3	39	22	17				
	7	12.0	13.5	17.8							
GAC-104	PT-2	2.5	3.0	26.7						98.0	2620
	3	3.5	5.0	21.8							
	4	5.0	6.5	20.0							
	5	7.5	9.0	16.5							
	6	10.0	11.5	16.3							
	8	12.0	13.5	18.0							
	9	15.0	16.5	18.0							
	10	17.5	19.0	17.2							
	11	20.0	21.5	10.7							
	12	22.5	23.0	6.6							
	13	25.0	25.5	6.0							
	14	27.5	28.0	5.9							
GAC-105	BAG	1.5	3.0	23.5				106.8	16.9		
DP-1	1	0.0	1.5	25.7							
	2	2.5	4.0	19.4	39	23	16				

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TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft.		Moisture Content, %	Atterberg Limits, %			Standard Proctor		Natural Dry Density, pcf	Unconf Compres Streng
		From	To		LL	PL	PI	Maximum Dry Density, pcf	Optimum Moisture Content, %		psf
DP-1	3	5.0	6.5	19.4							
	4	7.5	9.0	22.4							
	PT-5	11.5	12.0	23.7						101.8	1190
	6	12.0	13.5	25.6							
	7	15.0	16.5	21.1							
	8	17.5	19.0	22.8							
GAC-1	2	2.5	4.0	25.8							
	3	5.0	6.5	21.5							
	4	7.5	9.0	21.8							
	5	10.0	11.5	22.4							
	7	15.0	16.5	19.4							
	9	20.0	21.5	18.1							
	11	25.0	26.5	23.1							
	12	30.0	31.5	14.4							
	13	35.0	36.0	9.8							
	14	40.0	40.5	7.0							
GAC-2	1	0.0	1.5	21.5							
	2	2.5	4.0	13.4							
	3	5.0	6.5	20.6							
	4	7.5	9.0	17.1							
	5	10.0	11.5	13.7							
	6	12.5	14.0	21.5							
	7	15.0	17.0	23.1	27	19	6			108.6	3600
	8	17.0	18.5	25.6							
	9	20.0	22.0	22.2						107.8	3670
	10	22.0	23.5	23.2							
	11	25.0	26.5	26.2							
	12	30.0	31.5	20.7	51	26	25				

TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft. From	Depth, ft. To	Moisture Content, %	Atterberg Limits, % LL	Atterberg Limits, % PL	Atterberg Limits, % PI	Standard Proctor Maximum Dry Density, pcf	Standard Proctor Optimum Moisture Content, %	Natural Dry Density, pcf	Unconfi Compres Streng psf
GAC-2	13	35.0	36.0	24.3	45	26	19			104.0	2920
	15	40.0	41.5	18.0							
	16	45.0	46.5	17.6							
GAC-3	1	0.0	1.5	16.2							
	2	2.5	4.0	16.8							
	4	7.5	9.0	14.2							
	5	10.0	12.0	23.0	47	23	24			104.3	4230
	7	15.0	16.5	23.3							
	9	20.0	21.5	18.5							
	11	25.0	26.5	20.6							
	12	30.0	31.5	18.0							
	14	42.3	42.8	5.7						153.5	
GAC-4	1	0.0	1.5	21.2							
	3	5.0	6.5	16.1							
	4	7.5	9.0	17.1							
	5	10.0	10.4	17.7							
	6	12.5	14.0	15.8							
	8	17.0	18.5	17.4							
	9	20.0	21.5	16.4							
	10	22.5	23.4	9.0							
	11	25.0	25.5	6.8							
	12	30.0	30.5	5.1							
GAC-5	1	0.0	1.5	17.9							
	3	5.0	6.5	21.9							
	4	7.5	9.0	24.4							
	5	10.0	11.5	24.5							
	6	12.5	14.0	24.9							

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TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft.		Moisture Content, %	Atterberg Limits, %			Standard Proctor		Natural Dry Density, pcf	Unconfi Compres Streng	
		From	To		LL	PL	PI	Maximum Dry Density, pcf	Optimum Moisture Content, %		psf	
GAC-5	7	15.0	16.5	16.9								
	9	20.0	21.5	18.2								
	11	25.0	26.5	19.8								
	12	30.0	31.5	15.2								
	13	35.0	36.5	6.5								
GAC-8	1	0.0	1.5	19.0								
	2	2.5	4.0	19.7								
	3	5.0	7.0	23.0								
	5	10.0	11.5	29.9								
	7	15.0	16.5	26.8								
	9	20.0	21.5	22.1								
	11	25.0	26.5	23.6								
	12	30.0	31.5	27.8								
	13	35.0	36.5	25.3								
	13A	37.7	38.3	4.3								
	14	40.0	41.5	22.8								
	14A	42.0	42.5	7.0								
	15	45.0	46.5	24.9	30	19	11					
	16	50.0	51.5	23.4								
	17	55.0	56.5	21.3								
	18	60.0	61.5	21.3								
	19	65.0	66.5	10.4								
	20	70.0	70.5	11.2								
	22A	73.2	73.7	0.2						168.8		2
	22B	74.8	75.3	6.1						145.3		
	22C	76.1	76.5	4.4								
	22D	78.0	78.5	3.1								
SED-1	1	0.6	2.1	18.2								
	3	5.0	6.5	27.9								

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TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft. From	Depth, ft. To	Moisture Content, %	Atterberg Limits, % LL	PL	PI	Standard Proctor Maximum Dry Density, pcf	Optimum Moisture Content, %	Natural Dry Density, pcf	Unconfi Compres Streng psf	
SED-1		4	7.5	9.0	24.4							
		6	12.5	14.0	18.5							
		8	17.5	19.0	26.0	33	21	12				
		10	22.5	24.0	19.3							
		12	30.0	31.5	25.8							
		13	35.0	36.5	19.5							
		14	40.0	40.5	19.4							
		15	45.0	46.5	17.4							
		17	55.0	56.5	17.6							
		18	60.0	60.2	1.6							
SED-2	1	0.6	2.1	2.5				SED-2				
	3	5.0	6.5	28.5								
	5	10.0	11.5	25.4								
	7	15.0	16.5	22.4								
	9	20.0	21.5	23.0								
	11	25.0	26.5	26.3								
	13	35.0	36.5	21.2								
	15	45.0	46.5	12.8	33	18	15					
	16	50.0	50.4	14.5								
SED-3	1	1.0	2.5	19.1								
	3	5.0	6.5	25.7								
	5	10.0	11.5	25.5								
	7	15.0	16.5	21.4								
	9	20.0	21.5	23.2								
	11	25.0	26.5	25.6								
	13	35.0	36.5	22.3								
	14	40.0	41.5	21.3								

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TABULATION OF LABORATORY TESTS

Boring Number	Sample Number	Depth, ft. From	Depth, ft. To	Moisture Content, %	Atterberg Limits, % LL	PL	PI	Standard Proctor Maximum Dry Density, pcf	Standard Proctor Optimum Moisture Content, %	Natural Dry Density, pcf	Unconfi Compres Streng psf	
SED-3	15	45.0	46.5	16.6								
	16	50.0	51.5	21.0								
	17	55.0	56.5	16.8								
	18	60.0	61.2	5.5								
	19	65.0	65.4	4.8								
SED-4	1	0.8	2.3	25.6								
	3	5.0	6.5	20.6								
	5	10.0	11.5	25.5								
	7	15.0	16.5	25.5								
	9	20.0	21.5	26.7								
	11	25.0	26.5	23.2								
	13	35.0	36.5	26.0								
	15	45.0	46.5	22.5	55	23	32					
	17	55.0	56.5	16.5								
	19	65.0	66.5	9.3								

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM - D2166
UNIT WEIGHT AND NATURAL MOISTURE

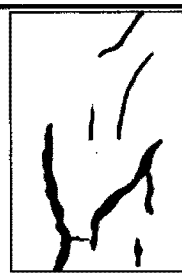
CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Upgrades, Taylor Mill Treatment Plant
LOCATION: Taylor Mill, Kentucky

PROJECT NO.: 081069E
BORING NO.: GAC-103 SAMPLE NO.: PT-2 DEPTH (ft.): 2.5-3.0
SAMPLE DESCRIPTION: Mottled brown and dark brown very moist stiff SILTY CLAY

SAMPLE OBTAINED BY: Shelby Tube CONDITION: Undisturbed DATE: 3/26/2010

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	2.84
HEIGHT (in.)	5.54
HEIGHT TO DIAMETER RATIO	1.95
AVERAGE AREA (sq. ft.)	0.0439
VOLUME (cu. ft.)	0.0203
WET WEIGHT (lbs.)	2.59
DRY WEIGHT (lbs.)	2.11
DRY DENSITY (pcf)	**103.9**

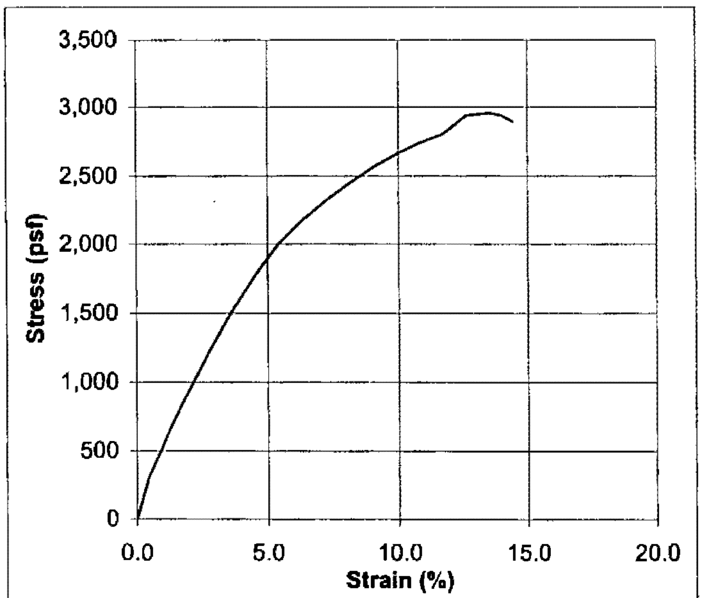
FAILURE SHAPE



WATER CONTENT AFTER SHEAR	
CAN NUMBER	E-8
WET WEIGHT + CAN (lbs.)	3.54
DRY WEIGHT + CAN (lbs.)	3.05
WEIGHT WATER (lbs.)	0.49
WEIGHT CAN (lbs.)	0.95
WEIGHT SOLID (lbs.)	2.10
MOISTURE (%)	**23.1**

PROVING RING NO.: 22714

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	CORR. AREA ($ft.^2$)	STRESS (psf)
0	0	0.0	0.0	0.0439	0
25	41	13.6	0.5	0.0441	309
50	68	22.0	0.9	0.0443	497
75	97	31.0	1.4	0.0445	697
100	123	39.1	1.8	0.0447	875
150	172	54.3	2.7	0.0451	1,204
200	218	68.6	3.6	0.0455	1,507
250	259	81.3	4.5	0.0459	1,770
300	296	92.8	5.4	0.0464	2,001
350	325	101.8	6.3	0.0468	2,175
400	350	109.6	7.2	0.0473	2,318
450	373	116.7	8.1	0.0477	2,445
500	395	123.6	9.0	0.0482	2,563
550	414	129.5	9.9	0.0487	2,659
600	431	134.8	10.8	0.0492	2,739
650	446	139.4	11.7	0.0497	2,805
700	457	147.6	12.6	0.0502	2,941
750	460	150.0	13.5	0.0507	2,956
775	460	150.0	14.0	0.0510	2,940
800	458	148.4	14.4	0.0513	2,895



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**0.5**
STRAIN AT FAILURE (%)	**13.5**
UNCONFINED COMPRESSIVE STRENGTH (psf)	**2,960**
SHEAR STRENGTH (psf)	**1,480**

REMARKS :

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM - D2166
UNIT WEIGHT AND NATURAL MOISTURE

CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Upgrades, Taylor Mill Treatment Plant
LOCATION: Taylor Mill, Kentucky

PROJECT NO.: 081069E
BORING NO.: GAC-104 SAMPLE NO.: PT-2 DEPTH (ft.): 2.5-3.0
SAMPLE DESCRIPTION: Mottled brown, trace dark gray very moist stiff SILTY CLAY, trace sand with roots and iron oxide stains

SAMPLE OBTAINED BY: Shelby Tube CONDITION: Undisturbed DATE: 3/26/2010

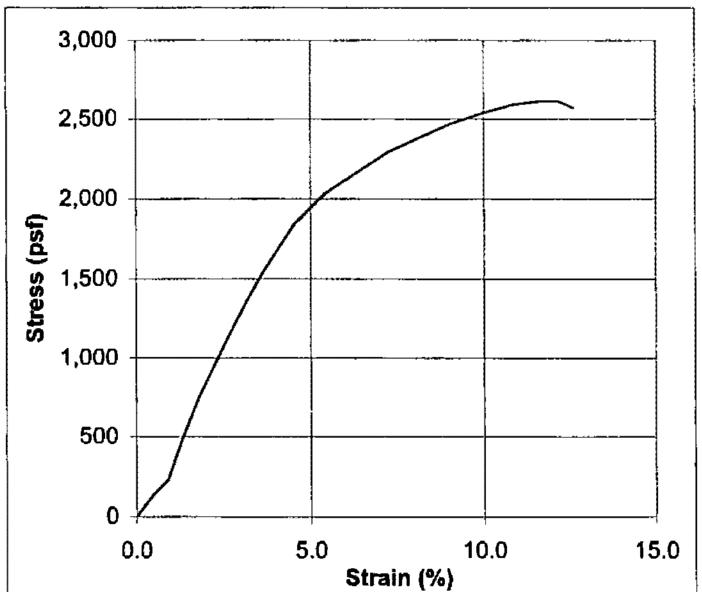
NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	2.82
HEIGHT (in.)	5.54
HEIGHT TO DIAMETER RATIO	1.97
AVERAGE AREA (sq. ft.)	0.0433
VOLUME (cu. ft.)	0.0200
WET WEIGHT (lbs.)	2.48
DRY WEIGHT (lbs.)	1.96
DRY DENSITY (pcf)	**98.0**

FAILURE SHAPE

WATER CONTENT AFTER SHEAR	
CAN NUMBER	G-8
WET WEIGHT + CAN (lbs.)	3.37
DRY WEIGHT + CAN (lbs.)	2.84
WEIGHT WATER (lbs.)	0.52
WEIGHT CAN (lbs.)	0.89
WEIGHT SOLID (lbs.)	1.95
MOISTURE (%)	**26.7**

PROVING RING NO.: 22714

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	CORR. AREA ($ft.^2$)	STRESS (psf)
0	0	0.0	0.0	0.0433	0
25	15	5.5	0.5	0.0435	127
50	29	9.9	0.9	0.0437	226
75	68	22.0	1.4	0.0439	501
100	104	33.2	1.8	0.0441	753
125	134	42.5	2.3	0.0443	960
150	164	51.8	2.7	0.0445	1,165
175	193	60.8	3.2	0.0447	1,361
200	219	68.9	3.6	0.0449	1,535
250	265	83.2	4.5	0.0453	1,835
300	297	93.1	5.4	0.0458	2,035
350	319	100.0	6.3	0.0462	2,164
400	341	106.8	7.2	0.0466	2,290
450	358	112.1	8.1	0.0471	2,379
500	375	117.4	9.0	0.0476	2,467
550	389	121.7	9.9	0.0480	2,533
600	402	125.8	10.8	0.0485	2,591
650	410	128.2	11.7	0.0490	2,615
675	412	128.9	12.2	0.0493	2,615
700	407	127.3	12.6	0.0495	2,570



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**0.6**
STRAIN AT FAILURE (%)	**11.7**
UNCONFINED COMPRESSIVE STRENGTH (psf)	**2,620**
SHEAR STRENGTH (psf)	**1,310**

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM - D2166
UNIT WEIGHT AND NATURAL MOISTURE

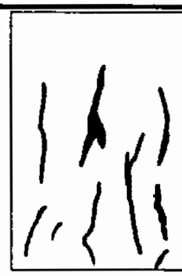
CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Upgrades, Taylor Mill Treatment Plant
LOCATION: Taylor Mill, Kentucky

PROJECT NO.: 081069E
BORING NO.: DP-1 SAMPLE NO.: PT-5 DEPTH (ft.): 10.2-10.6
SAMPLE DESCRIPTION: Mottled brown, trace dark brown, trace gray very moist medium stiff SILTY CLAY with iron oxide stains

SAMPLE OBTAINED BY: Shelby Tube CONDITION: Undisturbed DATE: 3/26/2010

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	2.86
HEIGHT (in.)	5.27
HEIGHT TO DIAMETER RATIO	1.85
AVERAGE AREA (sq. ft.)	0.0445
VOLUME (cu. ft.)	0.0195
WET WEIGHT (lbs.)	2.46
DRY WEIGHT (lbs.)	1.99
DRY DENSITY (pcf)	**101.8**

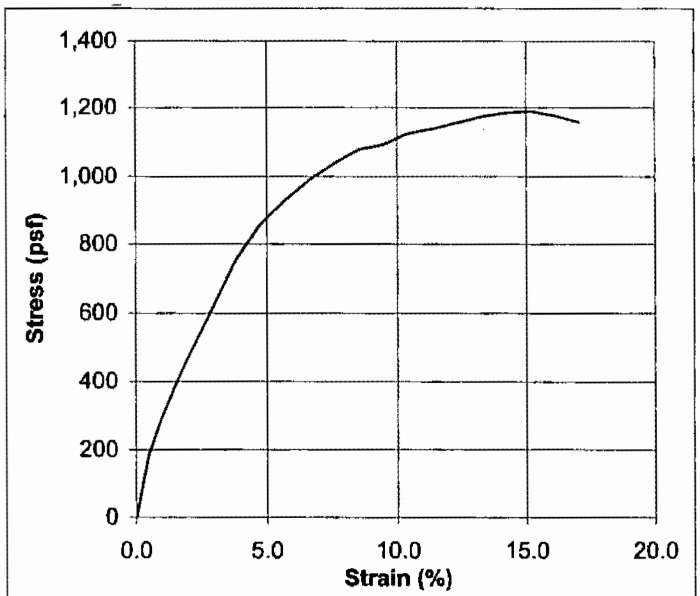
FAILURE SHAPE



WATER CONTENT AFTER SHEAR	
CAN NUMBER	S-13
WET WEIGHT + CAN (lbs.)	3.37
DRY WEIGHT + CAN (lbs.)	2.90
WEIGHT WATER (lbs.)	0.47
WEIGHT CAN (lbs.)	0.91
WEIGHT SOLID (lbs.)	1.98
MOISTURE (%)	**23.7**

PROVING RING NO.: 22714

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	CORR. AREA (ft.^{2})	STRESS (psf)
0	0	0.0	0.0	0.0445	0
25	24	8.3	0.5	0.0447	186
50	39	13.0	0.9	0.0449	289
75	52	17.0	1.4	0.0451	377
100	64	20.7	1.9	0.0453	458
150	86	27.6	2.8	0.0458	603
200	109	34.7	3.8	0.0462	752
250	126	40.0	4.7	0.0467	857
300	138	43.7	5.7	0.0471	928
350	149	47.2	6.6	0.0476	990
400	158	50.0	7.6	0.0481	1,038
450	166	52.4	8.5	0.0486	1,079
500	170	53.7	9.5	0.0491	1,093
550	177	55.9	10.4	0.0496	1,125
600	181	57.1	11.4	0.0502	1,138
700	191	60.2	13.3	0.0513	1,174
750	195	61.4	14.2	0.0518	1,185
800	198	62.4	15.2	0.0524	1,190
850	198	62.4	16.1	0.0530	1,177
900	197	62.1	17.1	0.0536	1,158



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**1.3**
STRAIN AT FAILURE (%)	**15.2**
UNCONFINED COMPRESSIVE STRENGTH (psf)	**1,190**
SHEAR STRENGTH (psf)	**595**

REMARKS :

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM - D2166
UNIT WEIGHT AND NATURAL MOISTURE

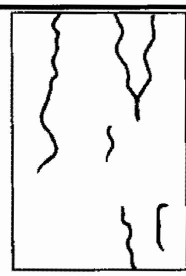
CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Facilities
LOCATION: Taylor Mill, Kentucky

PROJECT NUMBER: 081069E
BORING NO.: GAC2 SAMPLE NO.: 7 DEPTH (ft.): 15.0-17.0
SAMPLE DESCRIPTION: Brown, some gray moist medium stiff SILT CLAY, with silt and fine sand seams (varved)

SAMPLE OBTAINED BY: Shelby Tube CONDITION: Undisturbed DATE: 1/12/2009

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	2.87
HEIGHT (in.)	5.68
HEIGHT TO DIAMETER RATIO	1.98
AVERAGE AREA (sq. ft.)	0.0451
VOLUME (cu. ft.)	0.0213
WET WEIGHT (lbs.)	2.71
DRY WEIGHT (lbs.)	2.32
DRY DENSITY (pcf)	**108.6**

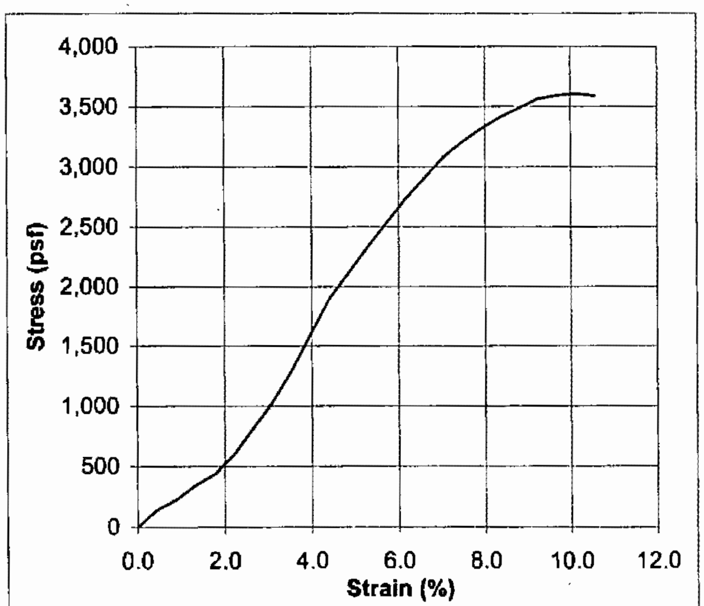
FAILURE SHAPE



WATER CONTENT AFTER SHEAR	
CAN NUMBER	S15
WET WEIGHT + CAN (lbs.)	3.62
DRY WEIGHT + CAN (lbs.)	3.22
WEIGHT WATER (lbs.)	0.40
WEIGHT CAN (lbs.)	0.91
WEIGHT SOLID (lbs.)	2.31
MOISTURE (%)	**17.1**

PROVING RING NO.: 22714

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	CORR. AREA (ft.^{2})	STRESS (psf)
0	0	0.0	0.0	0.0451	0
25	18	6.5	0.4	0.0452	143
50	30	10.2	0.9	0.0455	224
75	48	15.8	1.3	0.0457	346
100	61	19.8	1.8	0.0459	432
125	85	27.3	2.2	0.0461	592
150	118	37.5	2.6	0.0463	811
175	150	47.5	3.1	0.0465	1,021
200	190	59.9	3.5	0.0467	1,283
250	285	89.4	4.4	0.0471	1,897
300	354	110.8	5.3	0.0476	2,330
350	420	131.3	6.2	0.0480	2,736
400	459	149.2	7.0	0.0485	3,078
425	468	156.1	7.5	0.0487	3,206
450	476	162.2	7.9	0.0489	3,316
475	483	167.6	8.4	0.0492	3,410
500	489	172.2	8.8	0.0494	3,487
525	495	176.9	9.2	0.0496	3,563
550	498	179.2	9.7	0.0499	3,592
575	500	180.7	10.1	0.0501	3,605
600	500	180.7	10.6	0.0504	3,587



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**1.0**
STRAIN AT FAILURE (%)	**10.1**
UNCONFINED COMPRESSIVE STRENGTH (psf)	**3,600**
SHEAR STRENGTH (psf)	**1,800**

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM - D2166
UNIT WEIGHT AND NATURAL MOISTURE

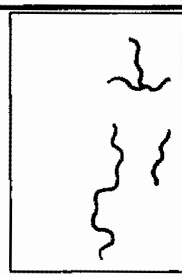
CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Facilities
LOCATION: Taylor Mill, Kentucky

PROJECT NUMBER: 081069E
BORING NO.: GAC2 SAMPLE NO.: 9 DEPTH (ft.): 20.0-22.0
SAMPLE DESCRIPTION: Mottled brown, trace gray moist stiff SILTY CLAY, with silt seams and iron oxide stains (varved)

SAMPLE OBTAINED BY: Shelby Tube CONDITION: Undisturbed DATE: 1/12/2009

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	2.86
HEIGHT (in.)	5.60
HEIGHT TO DIAMETER RATIO	1.96
AVERAGE AREA (sq. ft.)	0.0446
VOLUME (cu. ft.)	0.0208
WET WEIGHT (lbs.)	2.67
DRY WEIGHT (lbs.)	2.24
DRY DENSITY (pcf)	**107.8**

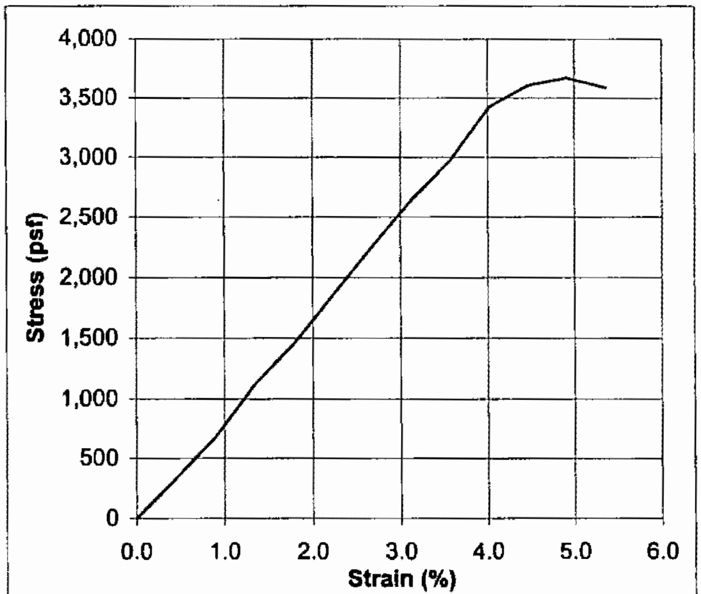
FAILURE SHAPE



WATER CONTENT AFTER SHEAR	
CAN NUMBER	S19
WET WEIGHT + CAN (lbs.)	3.59
DRY WEIGHT + CAN (lbs.)	3.17
WEIGHT WATER (lbs.)	0.42
WEIGHT CAN (lbs.)	0.95
WEIGHT SOLID (lbs.)	2.23
MOISTURE (%)	**18.9**

PROVING RING NO.: 22714

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	CORR. AREA ($ft.^2$)	STRESS (psf)
0	0	0.0	0.0	0.0446	0
25	45	14.8	0.4	0.0448	331
50	95	30.4	0.9	0.0450	675
75	160	50.6	1.3	0.0452	1,118
100	210	66.1	1.8	0.0454	1,455
125	270	84.7	2.2	0.0456	1,857
150	330	103.4	2.7	0.0458	2,255
175	390	122.0	3.1	0.0461	2,650
200	440	137.6	3.6	0.0463	2,973
225	472	159.2	4.0	0.0465	3,425
250	484	168.4	4.5	0.0467	3,606
275	489	172.2	4.9	0.0469	3,671
300	485	169.2	5.4	0.0471	3,589



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**1.0**
STRAIN AT FAILURE (%)	**4.9**
UNCONFINED COMPRESSIVE STRENGTH (psf)	**3,670**
SHEAR STRENGTH (psf)	**1,835**

REMARKS :

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM - D2166
UNIT WEIGHT AND NATURAL MOISTURE

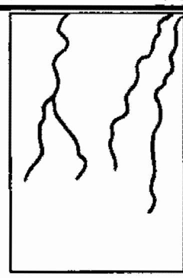
CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Facilities
LOCATION: Taylor Mill, Kentucky

PROJECT NUMBER: 081069E
BORING NO.: GAC2 SAMPLE NO.: 13 DEPTH (ft.): 35.0-36.0
SAMPLE DESCRIPTION: Brown, trace gray moist stiff SILTY CLAY, with randomly oriented limestone and shale fragments

SAMPLE OBTAINED BY: Shelby Tube CONDITION: Undisturbed DATE: 1/12/2009

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	2.88
HEIGHT (in.)	5.63
HEIGHT TO DIAMETER RATIO	1.96
AVERAGE AREA (sq. ft.)	0.0452
VOLUME (cu. ft.)	0.0212
WET WEIGHT (lbs.)	2.62
DRY WEIGHT (lbs.)	2.21
DRY DENSITY (pcf)	**104.0**

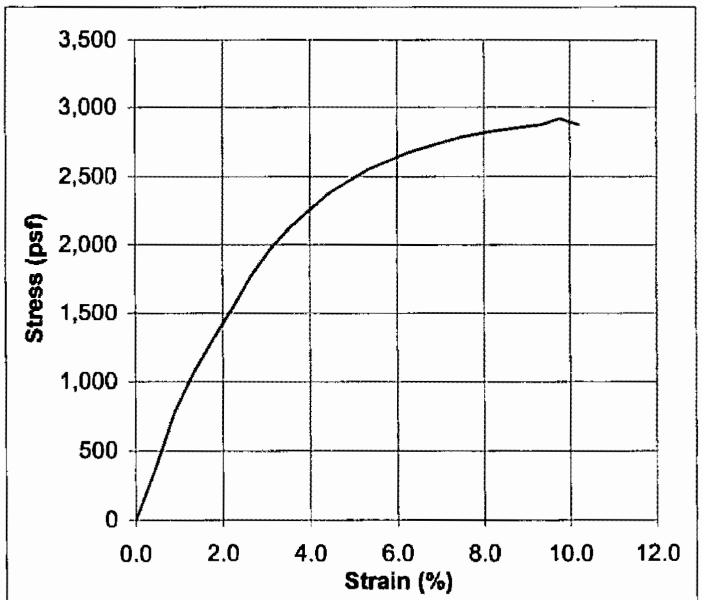
FAILURE SHAPE



WATER CONTENT AFTER SHEAR	
CAN NUMBER	LP-6
WET WEIGHT + CAN (lbs.)	3.52
DRY WEIGHT + CAN (lbs.)	3.10
WEIGHT WATER (lbs.)	0.42
WEIGHT CAN (lbs.)	0.90
WEIGHT SOLID (lbs.)	2.20
MOISTURE (%)	**18.9**

PROVING RING NO.: 22714

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	CORR. AREA ($ft.^2$)	STRESS (psf)
0	0	0.0	0.0	0.0452	0
25	50	16.4	0.4	0.0454	361
50	111	35.4	0.9	0.0456	776
75	154	48.7	1.3	0.0458	1,064
100	190	59.9	1.8	0.0460	1,302
125	225	70.8	2.2	0.0462	1,532
150	263	82.6	2.7	0.0464	1,779
175	293	91.9	3.1	0.0466	1,971
200	318	99.7	3.6	0.0468	2,128
250	359	112.4	4.4	0.0473	2,378
300	389	121.7	5.3	0.0477	2,551
350	411	128.6	6.2	0.0482	2,669
400	428	133.8	7.1	0.0486	2,752
425	436	136.3	7.5	0.0489	2,790
450	442	138.2	8.0	0.0491	2,814
475	447	140.0	8.4	0.0493	2,837
500	449	141.5	8.9	0.0496	2,854
525	451	143.0	9.3	0.0498	2,871
550	455	146.1	9.8	0.0501	2,918
575	453	144.6	10.2	0.0503	2,874



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**1.2**
STRAIN AT FAILURE (%)	**9.8**
UNCONFINED COMPRESSIVE STRENGTH (psf)	**2,920**
SHEAR STRENGTH (psf)	**1,460**

REMARKS :

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL, ASTM - D2166
UNIT WEIGHT AND NATURAL MOISTURE

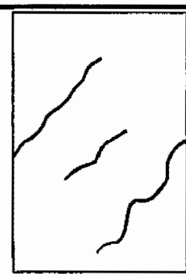
CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Facilities
LOCATION: Taylor Mill, Kentucky

PROJECT NUMBER: 081069E
BORING NO.: GAC 3 SAMPLE NO.: 5 DEPTH (ft.): 10.0-12.0
SAMPLE DESCRIPTION: Brown and gray moist stiff SILTY CLAY, with silt seams and limestone fragments

SAMPLE OBTAINED BY: Shelby Tube CONDITION: Undisturbed DATE: 1/12/2009

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	2.86
HEIGHT (in.)	5.65
HEIGHT TO DIAMETER RATIO	1.98
AVERAGE AREA (sq. ft.)	0.0446
VOLUME (cu. ft.)	0.0210
WET WEIGHT (lbs.)	2.63
DRY WEIGHT (lbs.)	2.19
DRY DENSITY (pcf)	**104.3**

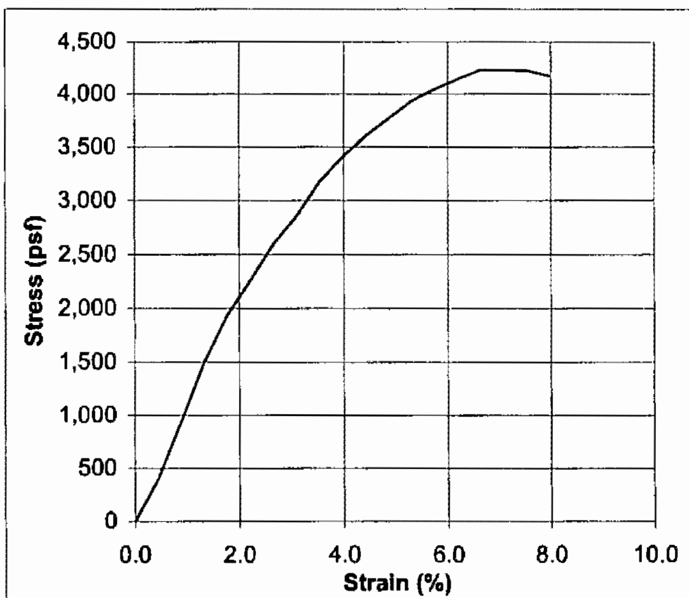
FAILURE SHAPE



WATER CONTENT AFTER SHEAR	
CAN NUMBER	LP3
WET WEIGHT + CAN (lbs.)	3.53
DRY WEIGHT + CAN (lbs.)	3.09
WEIGHT WATER (lbs.)	0.44
WEIGHT CAN (lbs.)	0.90
WEIGHT SOLID (lbs.)	2.19
MOISTURE (%)	**20.0**

PROVING RING NO.: 22714

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	CORR. AREA (ft.^{2})	STRESS (psf)
0	0	0.0	0.0	0.0446	0
25	54	17.6	0.4	0.0448	394
50	132	41.9	0.9	0.0450	930
75	215	67.7	1.3	0.0452	1,496
100	279	87.5	1.8	0.0454	1,928
125	329	103.1	2.2	0.0456	2,259
150	380	118.9	2.7	0.0458	2,595
175	420	131.3	3.1	0.0460	2,853
200	456	146.9	3.5	0.0463	3,176
225	471	158.4	4.0	0.0465	3,409
250	484	168.4	4.4	0.0467	3,608
275	495	176.9	4.9	0.0469	3,771
300	506	185.3	5.3	0.0471	3,933
325	514	191.5	5.8	0.0473	4,045
350	521	196.8	6.2	0.0476	4,139
375	528	202.2	6.6	0.0478	4,232
400	529	203.0	7.1	0.0480	4,228
425	530	203.8	7.5	0.0482	4,223
450	528	202.2	8.0	0.0485	4,172



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**0.7**
STRAIN AT FAILURE (%)	**6.6**
UNCONFINED COMPRESSIVE STRENGTH (psf)	**4,230**
SHEAR STRENGTH (psf)	**2,115**

REMARKS :

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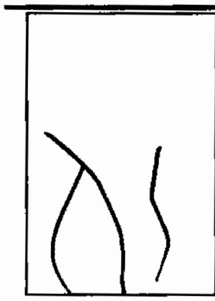
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE, ASTM - D2938
UNIT WEIGHT AND NATURAL MOISTURE

CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Facilities TMTP
LOCATION: Taylor Mill, Kentucky

PROJECT NUMBER: 081069E
BORING NO.: GAC 3 SAMPLE NO.: 14 DEPTH (ft.): 42.3-42.8
SAMPLE DESCRIPTION: Gray moist very weak moderately weatherd medium bedded calcareous SHALE
BEDROCK FORMATION: Kope Formation DATE: 2/9/2009
SAMPLE OBTAINED BY: Rock Core CONDITION: Undisturbed LOAD DIRECTION 90° TO LITHOLOGY

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	1.84
HEIGHT (in.)	4.59
HEIGHT TO DIAMETER RATIO	2.49
AVERAGE AREA (sq. ft.)	0.0185
VOLUME (cu. ft.)	0.0071
WET WEIGHT (lbs.)	1.15
DRY WEIGHT (lbs.)	1.09
DRY DENSITY (pcf)	**153.5**

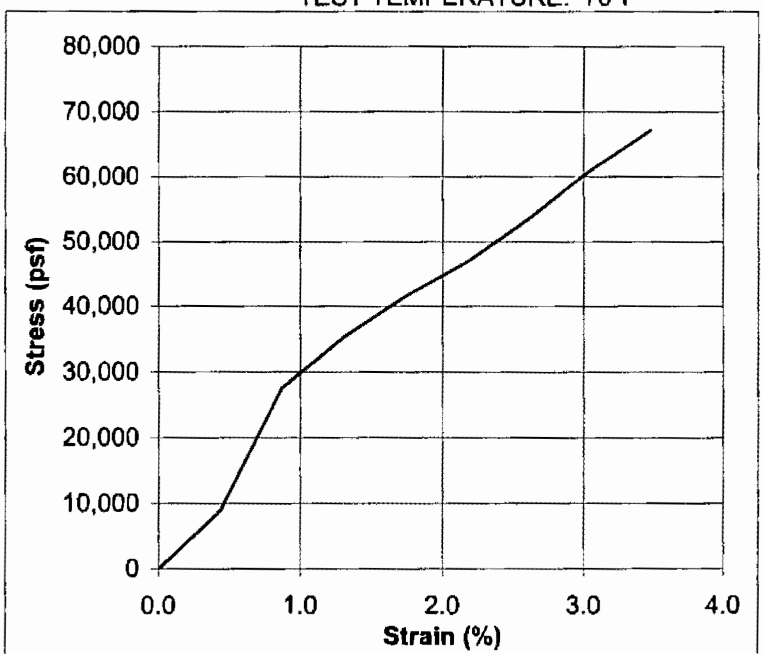
FAILURE SHAPE



WATER CONTENT AFTER SHEAR	
CAN NUMBER	a16
WET WEIGHT + CAN (lbs.)	2.04
DRY WEIGHT + CAN (lbs.)	1.98
WEIGHT WATER (lbs.)	0.06
WEIGHT CAN (lbs.)	0.89
WEIGHT SOLID (lbs.)	1.08
MOISTURE (%)	**5.7**

PROVING RING NO.: 19901 TEST TEMPERATURE: 70°F

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	STRESS (psf)
0	0	0	0.0	0
20	17	163	0.4	8,824
40	65	508	0.9	27,504
60	85	652	1.3	35,288
80	101	767	1.7	41,514
100	115	868	2.2	46,963
120	132	990	2.6	53,578
140	151	1,127	3.0	60,973
160	167	1,242	3.5	67,199



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**1.1**
STRAIN AT FAILURE (%)	**3.5**
UNCONFINED COMPRESSIVE STRENGTH (ksf)	**67.2**
SHEAR STRENGTH (ksf)	**33.6**

REMARKS :

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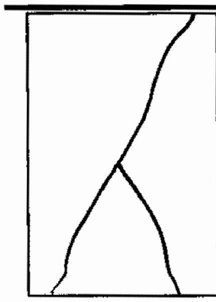
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE, ASTM - D2938
UNIT WEIGHT AND NATURAL MOISTURE

CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Facilities TMTP
LOCATION: Taylor Mill, Kentucky

PROJECT NUMBER: 081069E
BORING NO.: GAC 8 SAMPLE NO.: 22 DEPTH (ft.): 73.2-73.7
SAMPLE DESCRIPTION: Gray very strong unweathered thin to medium bedded medium to coarse crystalline grained locally fossiliferous LIMESTONE
BEDROCK FORMATION: Point Pleasant Formation DATE: 2/9/2009
SAMPLE OBTAINED BY: Rock Core CONDITION: Undisturbed LOAD DIRECTION 90° TO LITHOLOGY

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	1.87
HEIGHT (in.)	4.49
HEIGHT TO DIAMETER RATIO	2.41
AVERAGE AREA (sq. ft.)	0.0190
VOLUME (cu. ft.)	0.0071
WET WEIGHT (lbs.)	1.20
DRY WEIGHT (lbs.)	1.20
DRY DENSITY (pcf)	**168.8**

FAILURE SHAPE

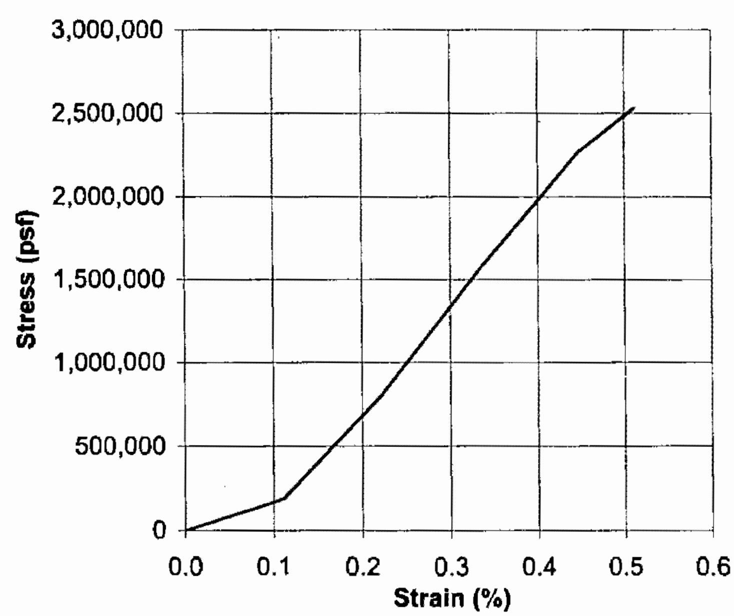


WATER CONTENT AFTER SHEAR	
CAN NUMBER	a3
WET WEIGHT + CAN (lbs.)	1.95
DRY WEIGHT + CAN (lbs.)	1.95
WEIGHT WATER (lbs.)	0.00
WEIGHT CAN (lbs.)	0.92
WEIGHT SOLID (lbs.)	1.03
MOISTURE (%)	**0.2**

PROVING RING NO.: QC200

TEST TEMPERATURE: 70°F

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	STRESS (psf)
0	0	0	0.0	0
5	3,585	3,585	0.1	188,975
10	15,350	15,350	0.2	809,139
15	29,745	29,745	0.3	1,567,938
20	42,895	42,895	0.4	2,261,110
23	48,050	48,050	0.5	2,532,843



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**0.1**
STRAIN AT FAILURE (%)	**0.5**
UNCONFINED COMPRESSIVE STRENGTH (ksf)	**2,532.8**
SHEAR STRENGTH (ksf)	**1266.4**

REMARKS :

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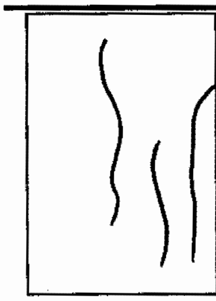
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE, ASTM - D2938
UNIT WEIGHT AND NATURAL MOISTURE

CLIENT : Malcolm Pirnie, Inc.
PROJECT: Geotechnical Exploration, Advanced Treatment Facilities TMTP
LOCATION: Taylor Mill, Kentucky

PROJECT NUMBER: 081069E
BORING NO.: GAC 8 SAMPLE NO.: 22 DEPTH (ft.): 74.8-75.3
SAMPLE DESCRIPTION: Gray moist very weak slightly weathered to unweathered thin to medium bedded calcareous SHALE
BEDROCK FORMATION: Point Pleasant Formation DATE: 2/9/2009
SAMPLE OBTAINED BY: Rock Core CONDITION: Undisturbed LOAD DIRECTION 90° TO LITHOLOGY

NATURAL UNIT WEIGHT	
AVERAGE DIAMETER (in.)	1.86
HEIGHT (in.)	4.18
HEIGHT TO DIAMETER RATIO	2.25
AVERAGE AREA (sq. ft.)	0.0188
VOLUME (cu. ft.)	0.0065
WET WEIGHT (lbs.)	1.01
DRY WEIGHT (lbs.)	0.95
DRY DENSITY (pcf)	**145.3**

FAILURE SHAPE

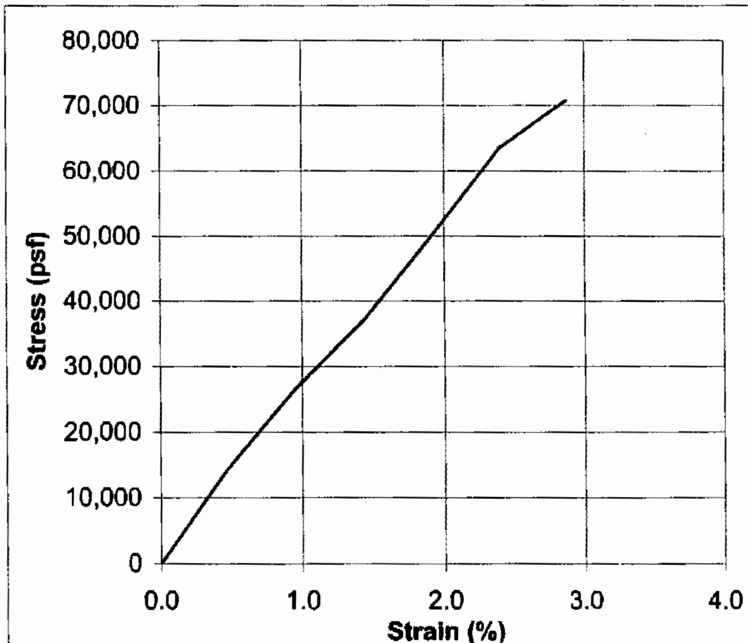


WATER CONTENT AFTER SHEAR	
CAN NUMBER	t20
WET WEIGHT + CAN (lbs.)	1.88
DRY WEIGHT + CAN (lbs.)	1.82
WEIGHT WATER (lbs.)	0.06
WEIGHT CAN (lbs.)	0.89
WEIGHT SOLID (lbs.)	0.93
MOISTURE (%)	**6.1**

PROVING RING NO.: 19901

DEFORM DIAL (0.001 in.)	LOAD DIAL (0.001 in.)	LOAD (lbs.)	STRAIN (%)	STRESS (psf)
0	0	0	0.0	0
20	32	271	0.5	14,441
40	64	501	1.0	26,707
60	91	695	1.4	37,057
80	125	940	1.9	50,090
100	160	1,192	2.4	63,506
120	179	1,329	2.9	70,789

TEST TEMPERATURE: 70°F



AVERAGE RATE OF STRAIN TO FAILURE (%/min.)	**0.7**
STRAIN AT FAILURE (%)	**2.9**
UNCONFINED COMPRESSIVE STRENGTH (ksf)	**70.8**
SHEAR STRENGTH (ksf)	**35.4**

REMARKS :

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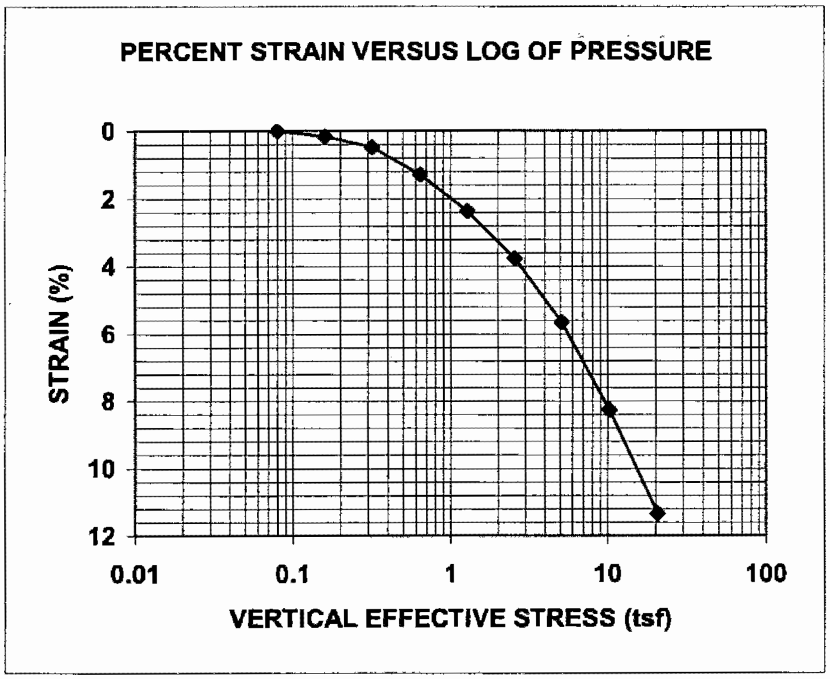
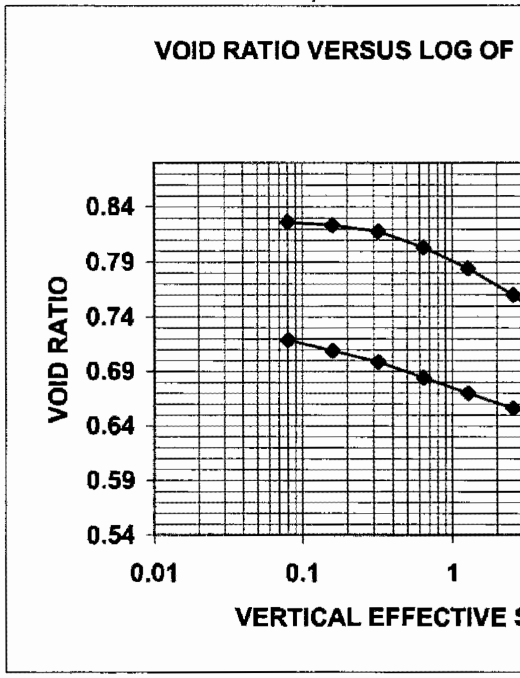
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS, ASTM D2435





TRIM METHOD	Cutting Shoe
TEST CONDITION	Inundated
SEAT LOAD (tsf)	0.05
TEST METHOD	B

	INITIAL	FINAL
WATER CONTENT (%)	23.7	26.9
DRY UNIT WEIGHT (pcf)	93.5	96.1
VOID RATIO	0.8287	0.7378
SATURATION (%)	78.4	100.0

SAMPLE DESCRIPTION			Brown, trace gray moist medium stiff SILTY CLAY with silt seams, partially varve					
GRAVEL	SAND	SILT	CLAY	LL	PL	PI	USCS CLASSIFICATION	SP
				27	19	6	CL-ML	

CLIENT	Malcolm Pirnie, Inc.			BORIN
PROJECT	Geotechnical Exploration, Advanced Treatment Facility, TMTP, Taylor Mill, Ky.			SAMPL
PROJECT #	081069E	DATE	2/11/2009	DEPTH

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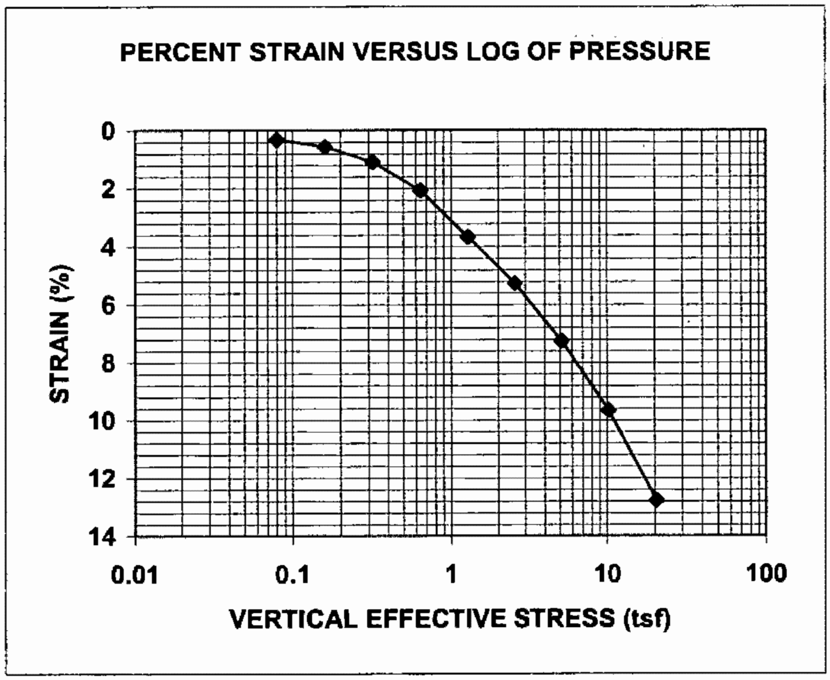
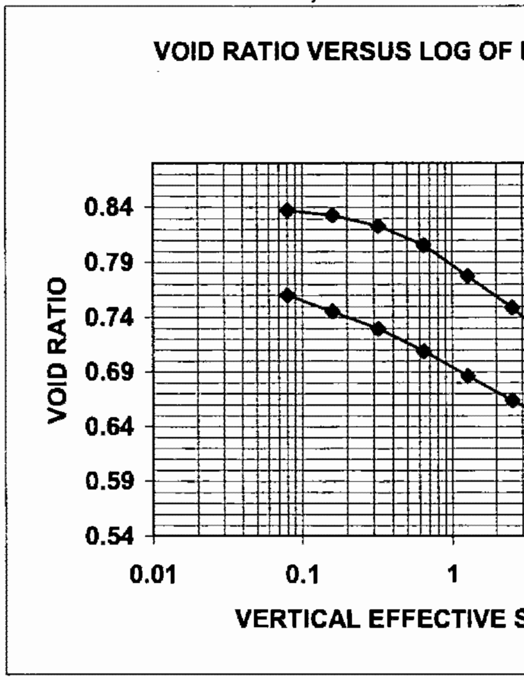
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS, ASTM D2435





TRIM METHOD	Cutting Shoe
TEST CONDITION	Inundated
SEAT LOAD (tsf)	0.05
TEST METHOD	B

	INITIAL	FINAL
WATER CONTENT (%)	24.1	28.6
DRY UNIT WEIGHT (pcf)	93.2	97.6
VOID RATIO	0.8425	0.7854
SATURATION (%)	78.7	100.0

SAMPLE DESCRIPTION	Brown and gray moist stiff SILTY CLAY with silt seams and limestone fragments							
GRAVEL	SAND	SILT	CLAY	LL	PL	PI	USCS CLASSIFICATION	SPE
				47	23	24	CL	

CLIENT	Malcolm Pirnie, Inc.			BORING
PROJECT	Geotechnical Exploration, Advanced Treatment Facility, TMTP, Taylor Mill, Ky.			SAMPLE
PROJECT #	081069E	DATE	1/8/2009	DEPTH

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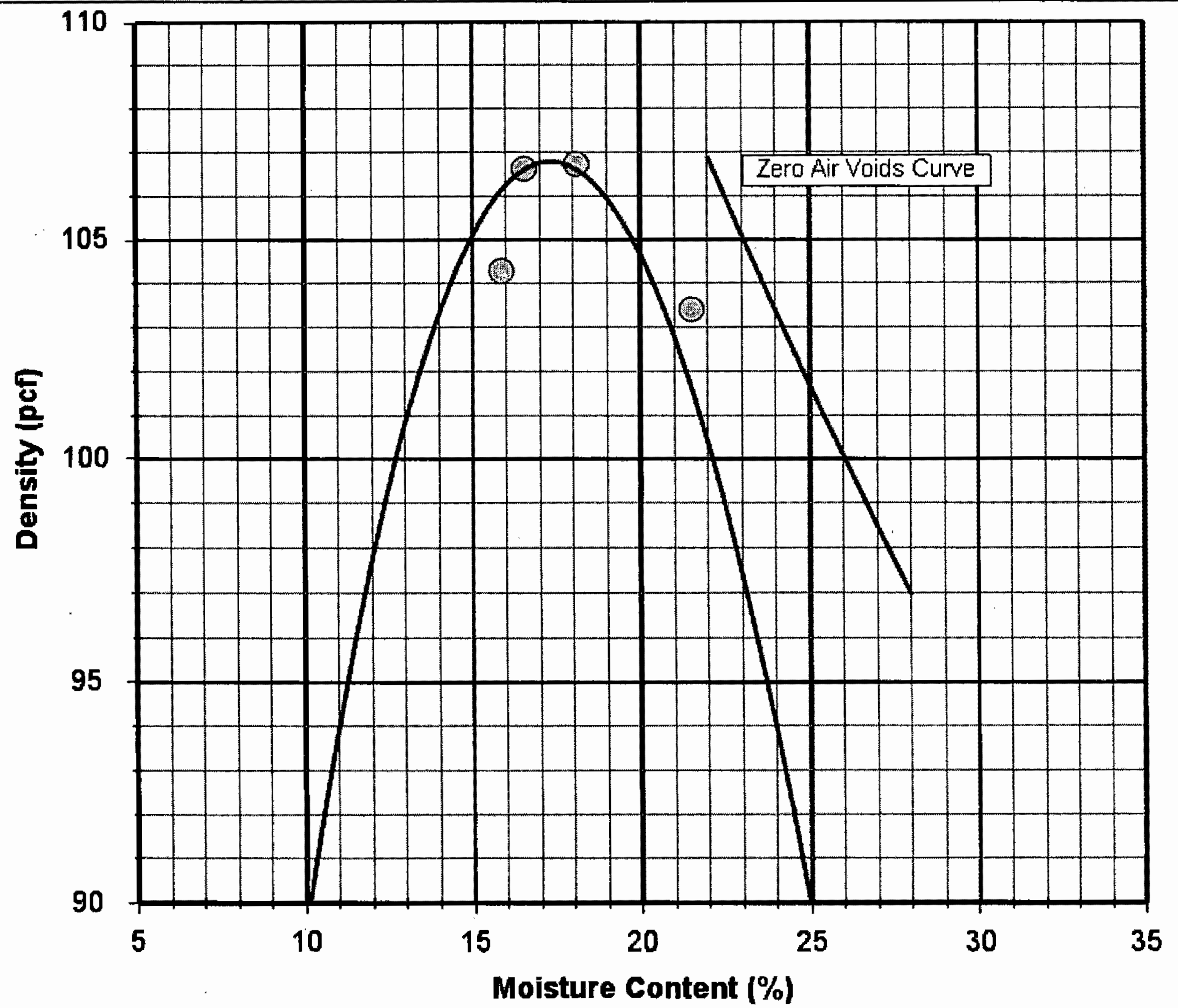
STANDARD PROCTOR MOISTURE DENSITY TEST, ASTM D698, METHOD A

Client:	Malcolm Pirnie, Inc.			Project No.:	081069
Project:	Advanced Treatment Upgrades, TMTP, Taylor Mill, KY			Date:	3/29/2010
Sample Obtained From:	Boring GAC-105, Bag Sample			Depth (ft.):	1.5-3.0
Sample Description:	Brown and gray moist medium stiff SILTY CLAY	LL	PL	PI	USCS
				-	
Maximum Dry Density (pcf):	106.8	Optimum Moisture Content:	17.0%	In Situ Moisture Content:	23.5%



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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC-101 (1of2)
PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E
LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	Cond	Blows/6"	No.	Type	Rec. (inches)
517.4	SURFACE	0.4						
517.0	TOPSOIL	2.0		I	1/3/3	1A 1B	DS	18
515.4	Brown moist stiff SILTY CLAY.							
512.9	Mottled brown and olive gray moist stiff SILTY CLAY.	4.5		I	4/4/5	2	DS	14
510.4	Brown moist very stiff SILTY CLAY, some clay with silt layers, partially varved.	7.0	5	I	8/11/12	3	DS	18
507.9	Mottled brown moist to very moist medium stiff SILTY CLAY, trace to little iron oxide stains.	9.5		I	8/3/3	4	DS	18
505.4	Mottled brown moist to very moist medium stiff SILTY CLAY with iron oxide stain (CL).	12.0	10	I	2/3/5	5	DS	13
500.4	Mottled brown moist medium stiff to stiff SILTY CLAY with iron oxide stains.	17.0	15	I	3/4/5	6	DS	18
				I	3/4/8	7	DS	18
495.4	Brown, trace gray moist very stiff SILTY CLAY, some clay with silt layers, partially varved.	22.0	20	I	4/5/8	8	DS	18
				I	3/4/4	9	DS	18
492.9	Mottled brown, moist stiff SILTY CLAY, trace clay, trace shale fragments with organics and limestone floaters.	24.5		I	5/9/10	10	DS	13
	Brown moist very stiff SILTY CLAY with limestone floaters and shale fragments (colluvium).		25	I	12/10/12	11	DS	13

Datum MSL | Hammer Wt. 140 lbs. | Hole Diameter 8 in. | Foreman LW & GB / BD-1
Surf. Elev. 517.4 ft. | Hammer Drop 30 in. | Rock Core Dia. -- in. | Engineer MAH
Date Started 3/8/10 | Pipe Size O.D. 2 in. | Boring Method 3-1/4" HSA | Date Completed 3/8/10

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED Trace @ 10.4 ft.
AT COMPLETION 40.0 ft.
AFTER -- hrs. -- ft.
BACKFILLED -- days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. BORING # GAC-101 (2of2)

PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky JOB #: 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
			30					
483.4	Brown moist very stiff SILTY CLAY with limestone floaters and shale fragments (colluvium).	34.0		I	4/5/8	12	DS	14
479.4	Interbedded brown, trace gray moist very soft highly weathered SHALE and gray hard LIMESTONE (bedrock). The shale is fissile.	38.0	35	I	12/38/44	13	DS	18
471.9	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock). The shale is fissile.	45.5	40	I	41/50/2"	14	DS	6
	Bottom of test boring at 45.5 feet.		45	I	50/6"	15	DS	6
			50					
			55					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman LW & GB / BD-1

Surf. Elev. 517.4 ft. Hammer Drop 30 in. Rock Core Dia. – in. Engineer MAH

Date Started 3/8/10 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 3/8/10

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED Trace @ 10.4 ft.
AT COMPLETION 40.0 ft.
AFTER – hrs. – ft.
BACKFILLED – days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC-102 (1of2)
PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E
LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (inches)
521.0	SURFACE	0.0						
519.0	Mixed brown moist stiff FILL, silty clay and topsoil, with limestone fragments.	2.0		I	3/4/5	1	DS	13
516.5	Mixed brown moist very stiff FILL, silty clay, trace fine to coarse gravel with cinders and asphalt fragments.	4.5	5	I	7/8/8	2	DS	13
514.0	Mixed dark green, trace brown very moist soft to medium stiff FILL, silty clay, trace sand and fine to coarse gravel with limestone fragments, organics and cinders (CL).	7.0		I	3/2/3	3	DS	8
513.0	Mixed brown moist stiff to very stiff FILL, silty clay.	8.0 / 8.5 / 9.5		I	2/3/4	4A 4B 4C	DS	18
512.5	TOPSOIL		10	I	4/5/6	5	DS	12
511.5	Mottled brown, some dark gray moist very stiff SILTY CLAY.	12.0						
509.0	Mottled brown, trace gray very moist stiff SILTY CLAY with limestone floaters.	14.5	15	I	3/5/7	6	DS	14
506.5	Brown, some olive gray moist stiff to very stiff SILTY CLAY.	17.0		I	3/4/4	7	DS	18
504.0	Brown moist medium stiff SILTY CLAY, trace fine sand.			I	3/4/7	8	DS	18
501.5	Mottled brown moist stiff to very stiff SILTY CLAY.	19.5	20					
499.0	Brown very moist medium stiff SILTY CLAY with wet silt layers, partially varved (CL).	22.0		I	2/3/3	9	DS	18
496.5	Brown very moist medium stiff to stiff SILTY CLAY with silt layers, partially varved.	24.5	25	I	3/4/7	10	DS	18
491.5	Mottled brown, trace olive gray moist very stiff SILTY CLAY, some clay, partially varved.	29.5		I	3/4/6	11	DS	18

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman LW & GB / BD-1
Surf. Elev. 521.0 ft. Hammer Drop 30 in. Rock Core Dia. – in. Engineer MAH
Date Started 3/8/10 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 3/8/10

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 8.0, 22.0 ft.
AT COMPLETION 44.0 ft.
AFTER – hrs. – ft.
BACKFILLED – days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #** GAC-102 (2of2)

PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB # :** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
			30					
	Orange-brown to mottled orange and gray very moist stiff plastic CLAY.			I	6/9/11	12	DS	18
488.0		33.0						
	Mottled brown, trace gray very moist stiff CLAY (CH).		35	I	6/6/8	13	DS	18
480.5		40.5	40					
	Interbedded brown to olive brown, some gray moist very soft highly weathered SHALE and gray hard LIMESTONE (bedrock).			I	8/17/27	14A 14B	DS	18
478.0		43.0						
	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock). The shale is fissile.		45	I	62/6"	15	DS	6
470.5		50.5	50					
	Bottom of test boring at 50.5 feet.			I	50/6"	16	DS	6
			55					

Datum MSL — Hammer Wt. 140 lbs. — Hole Diameter 8 in. — Foreman LW & GB / BD-1

Surf. Elev. 521.0 ft. — Hammer Drop 30 in. — Rock Core Dia. -- in. — Engineer MAH

Date Started 3/8/10 — Pipe Size O.D. 2 in. — Boring Method 3-1/4" HSA — Date Completed 3/8/10

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 8.0, 22.0 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION 44.0 ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER -- hrs. -- ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED -- days	MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC-103
PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, **JOB #:** 081069E
LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3 Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
505.6	SURFACE	0.0						
503.6	Mixed brown moist stiff FILL, silty clay, some topsoil, trace asphalt and limestone fragments.	2.0		I	2/3/3	1	DS	7
503.1	TOPSOIL	2.5		U		2	DS	17/24
502.1	Mottled brown and dark brown very moist stiff SILTY CLAY.	3.5		I	3/4/5	3	DS	18
498.6	Brown moist stiff SILTY CLAY, trace shale fragments, slicken sides at 3.7 feet (colluvium).	7.0	5	I	3/5/5	4	DS	18
491.1	Brown moist stiff SILTY CLAY, some shale fragments and limestone floaters (colluvium) (CL).	14.5	10	I	3/6/9	5	DS	18
				U		6	PT	12/24
				I	7/9/12	7	DS	16
488.6	Interbedded gray, some brown moist soft weathered SHALE and gray hard LIMESTONE (bedrock). The shale is fissile.	17.0	15	I	15/23/46	8	DS	18
485.1	Interbedded gray, trace brown moist soft SHALE and gray hard LIMESTONE (bedrock). The shale is fissile (bedrock).	20.5		I	36/50/6"	9	DS	12
	Bottom of test boring at 20.5 feet.		20	I	50/6"	10	DS	6
			25					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman LW / BD-1
Surf. Elev. 505.6 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer MAH
Date Started 3/5/10 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 3/5/10

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 17.0 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER -- hrs. -- ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED -- days	MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. BORING #: GAC-104

PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky JOB #: 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	Cond	Blows/6"	No.	Type	Rec. (inches)
520.4	SURFACE	0.2						
520.2	ASPHALT	1.5		I	8/2	1	DS	7
518.9	Mixed green, trace brown very moist medium stiff FILL, silty clay with crushed limestone, fine sand and cinders.			U		2	PT	18/24
		5.0		I	3/4/6	3	DS	13
515.4	Mixed brown, trace dark gray very moist medium stiff FILL, silty clay, trace sand with roots and iron oxide stains.		5	I	5/8/7	4	DS	13
513.4	Brown moist very stiff SILTY CLAY with iron oxide stains, limestone floaters, trace shale fragments (colluvium).	7.0		I	6/8/12	5	DS	18
510.9	Mottled brown, some gray moist very stiff SILTY CLAY, some clay with shale fragments (colluvium).	9.5	10	I	9/12/10	6	DS	13
		12.0		U		7	PT	6/6
508.4	Brown moist very stiff SILTY CLAY with limestone floaters and shale fragments (colluvium).			I	18/10/10	8	DS	14
505.9	Brown, trace gray moist very stiff SILTY CLAY, trace shale fragments (colluvium).	14.5	15	I	6/9/11	9	DS	10
503.4	Brown moist very stiff SILTY CLAY, trace shale fragments (colluvium).	17.0		I	6/10/14	10	DS	8
500.9	Interbedded brown moist soft highly weathered SHALE and gray hard LIMESTONE (bedrock).	19.5	20	I	16/22/50	11	DS	18
495.9	Interbedded brown, trace gray moist soft weathered SHALE and gray hard LIMESTONE (bedrock). The shale is fissile.	24.5		I	50/6"	12	DS	6
492.4	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock). The shale is fissile.	28.0	25	I	75/6"	13	DS	6
	Bottom of test boring at 28.0 feet.			I	75/6"	14	DS	6

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman LW & GB / BD-1

Surf. Elev. 520.4 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer MAH

Date Started 3/8/10 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 3/8/10

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 27.8 ft.
AT COMPLETION Dry ft.
AFTER -- hrs. -- ft.
BACKFILLED -- days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. BORING #: GAC-105

PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky JOB #: 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
519.7	SURFACE	0.4						
519.3	TOPSOIL			I	2/2/3	1A 1B	DS	18
515.2	Brown and gray moist medium stiff SILTY CLAY.	4.5		I	2/3/5	2	DS	10
512.7	Mottled brown moist stiff SILTY CLAY with iron oxide stains and limestone floaters, trace shale fragments (colluvium).	7.0	5	I	13/7/6	3	DS	10
507.7	Brown, trace gray moist very stiff SILTY CLAY with limestone floaters and shale fragments (colluvium).	12.0	10	I	4/6/9	4	DS	18
				I	8/12/14	5	DS	13
503.2	Brown moist very stiff SILTY CLAY with limestone floaters and shale fragments (colluvium).	16.5	15	I	13/9/14	6	DS	12
				I	8/8/11	7	DS	10
	Bottom of test boring at 16.5 feet.		20					
	Note: Bag sample taken from 1.5 to 3.0 feet.		25					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman LW & GB / BD-1

Surf. Elev. 519.7 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer MAH

Date Started 3/8/10 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 3/8/10

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED None ft.
AT COMPLETION Dry ft.
AFTER -- hrs. -- ft.
BACKFILLED -- days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. BORING #: DP-1
PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky JOB #: 081069E
LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (inches)
482.1	SURFACE	0.0						
480.4	Dark brown very moist medium stiff SILTY CLAY, trace hairlike roots (overbank deposits).	1.7		I	1/2/3	1	DS	12
478.6	Mottled brown moist to very moist medium stiff to stiff SILTY CLAY, some clay (CL).	4.5		I	4/6/7	2	DS	15
475.1	Mottled brown, trace dark brown, moist stiff to very stiff SILTY CLAY.	7.0	5	I	4/7/9	3	DS	18
472.6	Mottled brown and dark brown, trace gray very moist medium stiff SILTY CLAY.	9.5		I	3/4/5	4	DS	18
471.5	Mottled brown, trace dark brown, trace gray very moist medium stiff SILTY CLAY with iron oxide stains.	10.6	10	U		5	PT	24/24
467.6	Mottled brown, dark brown and gray very moist stiff SILTY CLAY with iron oxide stains.	14.5		I	3/2/4	6	DS	18
465.1	Brown, trace gray moist stiff SILTY CLAY.	17.0	15	I	2/3/6	7	DS	18
462.6	Gray, trace brown very moist loose clayey SILT, partially varved.	19.5		I	4/4/4	8	DS	18
460.6	Mottled olive brown and gray very moist stiff SILTY CLAY, trace shale fragments (colluvium).	21.5	20	I	4/5/8	9	DS	18
	Bottom of test boring at 21.5 feet. Note: A Shelby tube was pushed in an offset hole from 1.5-3.5 feet below the existing ground surface with 16 inches of recovery.		25					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman LW / BD-1
Surf. Elev. 482.1 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer MAH
Date Started 3/510 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 3/5/10

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 11.0 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION 17.0 ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER -- hrs. -- ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED -- days	MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. BORING #: DP-2
PROJECT: Geotechnical Exploration, Design Revisions, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky JOB #: 081069E
LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-3

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	Cond	Blows/6"	No.	Type	Rec. (Inches)
487.4	SURFACE	0.3					
487.1	TOPSOIL	2.0	I	2/3/6	1A 1B	DS	16
485.4	Brown very moist medium stiff SILTY CLAY.	4.5	I	4/6/6	2	DS	18
482.9	Brown moist to very moist stiff SILTY CLAY.						
475.4	Brown, trace gray moist stiff SILTY CLAY, partially varved.	12.0	I	4/6/8	3	DS	18
			I	4/4/6	4	DS	18
			I	3/4/5	5	DS	18
472.9	Brown very moist medium stiff very SILTY CLAY, some clayey silt, partially varved.	14.5	I	2/4/7	6	DS	18
470.9	Brown moist stiff SILTY CLAY, trace limestone floaters and shale fragments (colluvium).	16.5	I	4/7/10	7	DS	18
	Bottom of test boring at 16.5 feet.						

DEPTH SCALE (feet): 5, 10, 15, 20, 25

Datum MSL | Hammer Wt. 140 lbs. | Hole Diameter 8 in. | Foreman LW / BD-1
Surf. Elev. 487.4 ft. | Hammer Drop 30 in. | Rock Core Dia. -- in. | Engineer MAH
Date Started 3/5/10 | Pipe Size O.D. 2 in. | Boring Method 3-1/4" HSA | Date Completed 3/5/10

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 12.5 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER -- hrs. -- ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED -- days	MD - MUD DRILLING

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 1 (1 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
525.8	SURFACE	0.0						
	Mixed brown moist medium stiff FILL, silty clay and topsoil with hairlike roots, leaf litter, concrete and limestone fragments.			I	50/4"	1	DS	4
521.3		4.5		I	5/4/5	2	DS	5
518.8	Brown, some gray moist medium stiff SILTY CLAY, trace iron oxide stains.	7.0	5	I	2/4/4	3	DS	14
516.3	Brown, some gray moist stiff SILTY CLAY, with silt seams, trace limestone fragments, trace iron oxide stains.	9.5		I	4/5/6	4	DS	18
514.3	Brown, trace gray moist stiff CLAY, with silt seams, varved.	11.5	10	I	3/5/8	5	DS	18
	Brown, trace gray moist stiff SILTY CLAY, with silt seams, trace iron oxide stains, partially varved.			I	2/3/3	6	DS	18
508.8		17.0	15	I	14/11/8	7	DS	10
506.3	Brown, trace gray moist stiff SILTY CLAY, with limestone fragments, partially varved.	19.5		I	7/12/12	8	DS	5
503.8	Brown, trace gray moist very stiff SILTY CLAY, trace shale fragments.	22.0	20	I	10/12/15	9	DS	8
501.3	Brown, trace gray moist stiff SILTY CLAY, with silt seams.	24.5		I	4/8/11	10	DS	18
497.8	Brown moist medium stiff very SILTY CLAY, with fine sand seams.	28.0	25	I	5/6/7	11	DS	9

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman JS / TD-2
Surf. Elev. 525.8 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer LJC/TWV
Date Started 12/20/08 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 12/20/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 38.0 ft.
AT COMPLETION Dry ft.
AFTER 48 hrs. 20.2 ft.
BACKFILLED 10 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 1 (2 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
495.8			30					
	Interbedded brown, trace gray moist very soft highly weathered SHALE and gray hard LIMESTONE (bedrock).			I	5/8/17	12	DS	18
491.8		34.0						
	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).		35	I	17/50/6"	13	DS	11
485.3		40.5	40					
	Bottom of test boring at 40.5 feet.			I	50/6"	14	DS	6
			45					
			50					
			55					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman JS / TD-2

Surf. Elev. 525.8 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer LJC/TWV

Date Started 12/20/08 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 12/20/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 38.0 ft.
AT COMPLETION Dry ft.
AFTER 48 hrs. 20.2 ft.
BACKFILLED 10 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 2 (1 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (inches)
521.6	SURFACE	0.0						
517.6	Mixed brown and gray moist medium stiff FILL, silty clay with limestone and shale fragments, asphaltic concrete pieces, brick fragments, and hairlike roots.	4.0		I	2/2/3	1	DS	18
				I	9/9/15	2	DS	18
514.6	Mixed gray and black moist soft FILL, silty clay, with asphaltic concrete pieces.	7.0	5	I	17/40/5	3	DS	18
509.6	Mixed gray and olive brown moist soft FILL, silty clay with limestone fragments, gravel, wood fragments and asphaltic concrete pieces.	12.0		I	3/2/3	4	DS	18
			10	I	3/2/2	5	DS	12
507.1	Mottled brown, trace gray moist stiff SILTY CLAY, trace gravel.	14.5		I	3/3/4	6	DS	18
505.3	Brown, trace gray moist stiff SILTY CLAY, with silt seams (CL-ML).	16.3	15	U		7	PT	21/24
501.0	Brown, some gray moist medium stiff SILTY CLAY, with silt and fine sand seams, varved.	20.6		I	4/3/5	8	DS	18
			20	U		9	PT	24/24
497.6	Mottled brown, trace gray moist stiff SILTY CLAY, with silt seams, and iron oxide stains, varved.	24.0		I	3/3/6	10	DS	18
493.6	Brown and gray moist stiff SILTY CLAY, with silt seams and iron oxide stains, varved.	28.0	25	I	2/3/4	11	DS	18

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman JS / TD-2

Surf. Elev. 521.6 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer LJC/TWV

Date Started 12/21/08 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 12/21/08

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 45.0 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER 23 days 33.6 ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED 9 days	MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 2 (2 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE				
				Cond	Blows/6"	No.	Type	Rec. (inches)
491.6			30					
490.1	Bluish gray to olive brown moist very stiff CLAY (CH).	31.5		I	4/7/10	12	DS	18
	Brown, trace gray moist stiff SILTY CLAY, with randomly oriented limestone and shale fragments (CL).		35	U		13	PT	11/24
				I	5/7/7	14	DS	18
482.1		39.5						
478.6	Interbedded brown and gray moist very soft highly weathered SHALE and gray hard LIMESTONE (bedrock).	43.0	40	I	10/14/19	15	DS	18
476.2	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	45.4	45					
	Bottom of test boring at 45.4 feet.			I	50/4"	16	DS	4
	Note: A piezometer was installed in this bore hole with a 10-foot well screen from 35.4 to 45.4 feet, sand backfill from 5 to 45.4 feet, and a bentonite plug from 0 to 5 feet. Water was measured in this piezometer at a depth of 33.6 feet on January 13, 2009. Water was measured at a depth of 32.8 feet on February 16, 2009.		50					
			55					

Datum MSL | Hammer Wt. 140 lbs. | Hole Diameter 8 in. | Foreman JS / TD-2

Surf. Elev. 521.6 ft. | Hammer Drop 30 in. | Rock Core Dia. -- in. | Engineer LJC/TWV

Date Started 12/21/08 | Pipe Size O.D. 2 in. | Boring Method 3-1/4" HSA | Date Completed 12/21/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 45.0 ft.
AT COMPLETION Dry ft.
AFTER 23 days 33.6 ft.
BACKFILLED 9 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING # :** GAC 3 (1 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB # :** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
525.9	SURFACE	0.0						
	Mixed brown moist very stiff FILL, silty clay with limestone and shale fragments.			I	4/5/8	1	DS	15
523.9		2.0						
	Mixed black and brown to greenish brown, moist stiff to medium stiff FILL, silty clay, with asphaltic concrete, brick, wood, and limestone fragments.			I	8/14/12	2	DS	18
			5	I	4/4/3	3	DS	10
				I	2/3/2	4	DS	4
515.6		10.3	10					
	Brown and gray moist stiff SILTY CLAY, with silt seams and limestone fragments (CL).			U		5	PT	20/24
				I	3/4/5	6	DS	18
			15	I	6/7/7	7	DS	3
508.9		17.0						
	Brown, trace gray moist very stiff SILTY CLAY, with limestone and shale fragments, trace hairlike roots and iron oxide stains.			I	3/7/11	8	DS	10
			20	I	5/9/14	9	DS	18
				I	6/9/18	10	DS	7
			25	I	6/7/11	11	DS	7
497.9		28.0						

Datum MSL | Hammer Wt. 140 lbs. | Hole Diameter 8 in. | Foreman JS / TD-2

Surf. Elev. 525.9 ft. | Hammer Drop 30 in. | Rock Core Dia. 1-7/8 in. | Engineer LJC/TWV

Date Started 12/20/08 | Pipe Size O.D. 2 in. | Boring Method 3-1/4" HSA | Date Completed 12/20/08

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 31.2 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION 20.0 ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER 48 hrs. 10.1 ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED 10 days	MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 3 (2 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
495.9			30					
492.9	Interbedded gray and brown moist soft weathered SHALE and gray hard LIMESTONE (bedrock).	33.0		I	17/33/50	12	DS	17
490.9	Interbedded gray moist very weak to weak slightly weathered to unweathered medium bedded calcareous SHALE, trace gray medium strong finely crystalline grained thin bedded LIMESTONE. The limestone occurs in 1 to 2-inch beds, and comprises aprpoximately 8.3 % of this interval. (Kope Formation Bedrock)	35.0	35		RQD = 40%	13	RC	24/24
480.9	Interbedded gray moist very weak to weak moderately weathered to unweathered medium bedded calcareous SHALE, trace gray medium strong finely crystalline grained thin bedded LIMESTONE. The limestone occurs in 1 to 2-inch beds and comprises approximately 2.5 % of this interval. (Kope Formation)	45.0	40 / 45		RQD = 46%	14	RC	120/120
	Bottom of test boring at 45.0 feet.		50 / 55					

Datum	MSL	Hammer Wt.	140 lbs.	Hole Diameter	8 in.	Foreman	JS / TD-2
Surf. Elev.	525.9 ft.	Hammer Drop	30 in.	Rock Core Dia.	1-7/8 in.	Engineer	LJC/TWV
Date Started	12/20/08	Pipe Size	O.D. 2 in.	Boring Method	3-1/4" HSA	Date Completed	12/20/08

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 31.2 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION 20.0 ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER 48 hrs. 10.1 ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED 10 days	MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 4

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (inches)
531.9	SURFACE	0.0						
	Mixed brown moist medium stiff to stiff FILL, silty clay, trace topsoil, shale and wood fragments and hairlike roots.			I	2/2/3	1	DS	16
527.4		4.5		I	4/5/7	2	DS	18
524.9	Mixed brown to dark brown moist stiff FILL, very silty clay.	7.0	5	I	4/5/6	3	DS	18
522.4	Mottled brown moist very stiff SILTY CLAY, with iron oxide stains.	9.5		I	5/6/7	4	DS	18
519.9	Brown some gray moist stiff SILTY CLAY, with silt seams and limestone floaters.	12.0	10	I	50/5"	5	DS	3
	Brown, trace gray moist very stiff SILTY CLAY, with randomly oriented limestone and shale fragments.			I	9/8/9	6	DS	12
			15	D		7	PT	4/24
				I	10/12/14	8	DS	3
509.9		22.0	20	I	6/9/14	9	DS	10
507.4	Interbedded brown and gray moist soft weathered SHALE and gray hard LIMESTONE (bedrock).	24.5		I	19/50/5"	10	DS	11
503.9	Interbedded gray, trace brown moist soft weathered SHALE and gray hard LIMESTONE (bedrock).	28.0	25	I	Note: Scale Change 50/6"	11	DS	6
501.4	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	30.5	30	I	62/6"	12	DS	6
	Bottom of test boring at 30.5 feet.							

Datum MSL	Hammer Wt. 140 lbs.	Hole Diameter 8 in.	Foreman JS / TD-2
Surf. Elev. 531.9 ft.	Hammer Drop 30 in.	Rock Core Dia. -- in.	Engineer LJC/TWV
Date Started 12/20/08	Pipe Size O.D. 2 in.	Boring Method 3-1/4" HSA	Date Completed 12/20/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED Dry ft.
AT COMPLETION Dry ft.
AFTER 48 hrs. 20.1 ft.
BACKFILLED 10 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 5

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
529.9	SURFACE	0.0						
	Mixed brown to olive brown moist medium stiff FILL, silty clay, with gravel and fine to medium sand.			I	2/3/3	1	DS	3
527.9		2.0						
	Mixed brown, gray and black moist medium stiff FILL, silty clay with gravel, fine to coarse sand, limestone fragments, asphaltic concrete pieces, trace paper and organic matter.			I	7/7/10	2	DS	18
			5	I	5/4/3	3	DS	12
522.9		7.0						
	Mixed greenish gray, trace brown and black moist stiff FILL, silty clay with limestone, asphaltic concrete, and wood fragments.			I	2/5/3	4	DS	18
520.4		9.5						
	Brown, trace gray moist medium stiff SILTY CLAY.		10	I	2/3/4	5	DS	18
517.9		12.0						
	Brown and gray moist stiff SILTY CLAY, with silt seams, varved.			I	4/5/7	6	DS	18
515.4		14.5						
	Brown, trace gray moist stiff SILTY CLAY, with randomly oriented limestone and shale fragments, trace iron oxide stains.		15	I	5/6/7	7	DS	18
				I	3/5/7	8	DS	18
					Note: Scale Change			
			20	I	6/7/10	9	DS	18
				I	3/7/5	10	DS	18
			25	I	12/8/8	11	DS	18
501.9		28.0						
	Interbedded brown moist very soft highly weathered SHALE and gray hard LIMESTONE (bedrock).		30	I	9/14/24	12	DS	18
496.9		33.0						
	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).		35	I	50/6"	13	DS	1
494.4		35.5						
	Bottom of test boring at 35.5 feet.							

Datum	MSL	Hammer Wt.	140 lbs.	Hole Diameter	8 in.	Foreman	JS / TD-2
Surf. Elev.	529.9 ft.	Hammer Drop	30 in.	Rock Core Dia.	– in.	Engineer	LJC/TWV
Date Started	12/21/08	Pipe Size	O.D. 2 in.	Boring Method	3-1/4" HSA	Date Completed	12/21/08

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 35.0 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER 48 hrs. Dry ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED 9 days	MD - MUD DRILLING

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** SED 1 (1 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
523.7	SURFACE	0.0						
523.1	ASPHALT	0.6		I	6/7/5	1	DS	18
516.7	Mixed brown and greenish brown moist stiff FILL, silty clay, with limestone gravel and concrete fragments.	7.0		I	3/3/6	2	DS	18
			5	I	2/3/5	3	DS	18
514.2	Brown and gray moist stiff CLAY, with silt seams, varved.	9.5		I	2/4/5	4	DS	18
511.7	Brown moist medium stiff SILTY CLAY, trace fine sand.	12.0	10	I	2/3/3	5	DS	18
509.2	Brown moist stiff SILTY CLAY.	14.5		I	2/3/5	6	DS	18
			15	I	2/4/6	7	DS	18
				I	2/3/4	8	DS	18
501.7	Brown, reddish brown and gray moist medium stiff SILTY CLAY, trace silt seams and iron oxide stains (CL).	22.0	20	I	2/3/3	9	DS	18
499.2	Brown moist very stiff SILTY CLAY, trace iron oxide stains.	24.5		I	2/3/3	10	DS	18
			25	I	3/4/6	11	DS	18
495.7	Gray with brown, moist stiff SILTY CLAY, with silt seams, varved.	28.0						

Datum MSL	Hammer Wt. 140 lbs.	Hole Diameter 8 in.	Foreman JS / TD-2
Surf. Elev. 523.7 ft.	Hammer Drop 30 in.	Rock Core Dia. -- in.	Engineer LJC/TWV
Date Started 12/10/08	Pipe Size O.D. 2 in.	Boring Method 3-1/4" HSA	Date Completed 12/10/08

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 21.0 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER 48 hrs. 8.1 ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED 9 days	MD - MUD DRILLING

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** SED 1 (2 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (inches)
493.7			30					
	Gray moist stiff SILTY CLAY, with silt seams.			I	3/3/3	12	DS	18
490.7		33.0						
	Mottled brown and gray moist very stiff CLAY.		35	I	3/4/6	13	DS	18
485.7		38.0						
	Brown moist very stiff SILTY CLAY with limestone and shale fragments and limestone floaters.		40	I	50/6"	14	DS	6
480.7		43.0						
	Olive brown and gray moist very stiff SILTY CLAY, with randomly oriented shale and limestone fragments and floaters.		45	I	6/9/12	15	DS	18
			50	I	7/9/16	16	DS	12
					Note: Scale Change			
			55	I	9/11/14	17	DS	15
464.7		59.0						
463.5	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	60.2	60	I	50/2"	18	DS	1
	Bottom of test boring at 60.2 feet.							

Datum MSL | Hammer Wt. 140 lbs. | Hole Diameter 8 in. | Foreman JS / TD-2

Surf. Elev. 523.7 ft. | Hammer Drop 30 in. | Rock Core Dia. -- in. | Engineer LJC/TWV

Date Started 12/10/08 | Pipe Size O.D. 2 in. | Boring Method 3-1/4" HSA | Date Completed 12/10/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 21.0 ft.
AT COMPLETION Dry ft.
AFTER 48 hrs. 8.1 ft.
BACKFILLED 9 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. BORING #: SED 2 (1 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky JOB #: 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
521.4	SURFACE	0.0						
520.8	CONCRETE	0.6		I	10/42/14	1	DS	5
519.1	Mixed gray and brown moist very dense FILL, sand and gravel with some clay, trace asphaltic concrete pieces.	2.3		I	3/4/7	2	DS	18
	Mixed brown and gray moist medium stiff to stiff FILL, silty clay.		5	I	3/3/7	3	DS	18
511.9		9.5		I	1/1/2	4	DS	18
509.9	Mixed brown, gray and black moist medium stiff FILL, silty clay with asphaltic concrete and brick pieces.	11.5	10	I	1/2/2	5	DS	18
506.9	Mixed brown and gray moist stiff FILL, silty clay with silt and fine sand, trace limestone gravel, shale fragments and roots.	14.5		I	2/3/4	6	DS	18
504.4	Brown, gray and reddish brown moist medium stiff to stiff SILTY CLAY.	17.0	15	I	2/4/5	7	DS	18
	Brown moist stiff SILTY CLAY.			I	4/4/7	8	DS	18
499.4		22.0	20	I	3/4/4	9	DS	18
496.9	Brown, gray and reddish brown moist stiff SILTY CLAY.	24.5		I	2/4/5	10	DS	18
493.4	Brown, olive brown and gray moist stiff SILTY CLAY, with silt seams, varved.	28.0	25	I	3/4/6	11	DS	18

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman JS / TD-2

Surf. Elev. 521.4 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer LJC/TWV

Date Started 12/12/08 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 12/12/08

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED Trace 11.2/28 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION 43.6 ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER 48 hrs. 10.9 ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED 7 days	MD - MUD DRILLING

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** SED 2 (2 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)
491.4		
488.4	Gray, trace brown moist medium stiff SILTY CLAY, with silt seams, varved.	33.0
483.4	Mottled brown and gray moist very stiff CLAY, trace iron oxide stains.	38.0
472.9	Gray and olive brown moist very stiff SILTY CLAY, with limestone and shale fragments and limestone floaters (CL).	48.5
468.4	Interbedded gray, trace olive brown moist soft weathered SHALE and gray hard LIMESTONE (bedrock).	53.0
	Auger refusal at 53.0 feet.	

Depth scale (feet): 30, 35, 40, 45, 50, 55

SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
I	2/4/5	12	DS	18
I	4/5/8	13	DS	18
I	9/12/17	14	DS	18
I	12/14/18	15	DS	18
I	50/5"	16	DS	3

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman JS / TD-2
Surf. Elev. 521.4 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer LJC/TWV
Date Started 12/12/08 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 12/12/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED Trace 11.2/28 ft.
AT COMPLETION 43.6 ft.
AFTER 48 hrs. 10.9 ft.
BACKFILLED 7 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** SED 3 (1 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (inches)
519.5	SURFACE	0.0						
518.5	ASPHALT	1.0						
517.0	Brown and gray moist medium stiff to stiff SILTY CLAY.	2.5		I	2/2/3	1	DS	9
515.0	Brown and tan moist stiff SILTY CLAY, with silt seams.	4.5		I	4/4/5	2	DS	18
512.5	Brown, trace gray moist stiff SILTY CLAY, with silt seams.	7.0	5	I	2/4/4	3	DS	18
505.0	Brown, trace gray moist medium stiff SILTY CLAY.	14.5	10	I	2/3/3	4	DS	18
				I	3/3/5	5	DS	18
				I	4/3/5	6	DS	18
500.5	Brown moist stiff SILTY CLAY.	19.0	15	I	3/3/5	7	DS	18
				I	2/3/4	8	DS	18
497.5	Brown, trace tan moist stiff SILTY CLAY, with silt seams and iron oxide stains.	22.0	20	I	4/6/8	9	DS	18
495.0	Brown and gray moist medium stiff to stiff SILTY CLAY, partially varved.	24.5		I	2/3/4	10	DS	18
491.5	Gray and olive brown moist stiff SILTY CLAY, with silt seams, varved.	28.0	25	I	3/3/5	11	DS	18

Datum MSL | Hammer Wt. 140 lbs. | Hole Diameter 8 in. | Foreman JS / TD-2

Surf. Elev. 519.5 ft. | Hammer Drop 30 in. | Rock Core Dia. -- in. | Engineer LJC/TWV

Date Started 12/17/08 | Pipe Size O.D. 2 in. | Boring Method 3-1/4" HSA | Date Completed 12/17/08

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED 20.9 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION 31.4 ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER 48 hrs. 17.2 ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED 2 days	MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. BORING #: SED 3 (2 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky JOB #: 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
489.5			30					
	Gray moist stiff SILTY CLAY, with silt seams, varved.			I	2/4/5	12	DS	18
			35	I	2/4/5	13	DS	18
481.5		38.0						
	Bluish gray and olive brown moist stiff SILTY CLAY, with randomly oriented limestone fragments.		40	I	3/5/8	14	DS	8
477.5		42.0						
	Gray moist medium stiff sandy CLAY, with limestone fragments.		45	I	3/4/7	15	DS	18
471.5		48.0			Note: Scale Change			
	Gray, trace brown moist medium stiff CLAY.		50	I	4/4/6	16	DS	18
466.5		53.0						
	Gray moist stiff SILTY CLAY, with randomly oriented shale and limestone fragments and limestone floaters.		55	I	50/6"	17	DS	6
461.5		58.0						
	Interbedded gray, trace brown moist soft weathered SHALE and gray hard LIMESTONE (bedrock).		60	I	19/26/50/8"	18	DS	14
454.1		65.4	65	I	50/5"	19	DS	5
	Bottom of test boring at 65.4 feet.							

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman JS / TD-2

Surf. Elev. 519.5 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer LJC/TWV

Date Started 12/17/08 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 12/17/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 20.9 ft.
AT COMPLETION 31.4 ft.
AFTER 48 hrs. 17.2 ft.
BACKFILLED 2 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** SED 4 (1 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	Cond	Blows/6"	No.	Type	Rec. (Inches)
522.7	SURFACE	0.2						
522.5	ASPHALT	0.8		I	2/2/3	1	DS	7
521.9	CONCRETE	2.5		I	5/5/8	2	DS	18
520.2	Brown, trace gray moist medium stiff to stiff SILTY CLAY, with silt seams, varved.	4.5	5					
518.2	Brown moist stiff SILTY CLAY.	7.0		I	3/3/6	3	DS	18
515.7	Brown moist stiff SILTY CLAY, trace organics and iron oxide stains.	9.5		I	3/4/6	4	DS	18
513.2	Brown, trace gray and tan moist stiff CLAY, with silt seams, varved.	12.0	10	I	3/4/5	5	DS	18
510.7	Brown and gray moist medium stiff SILTY CLAY, trace iron oxide stains.	14.5		I	4/5/7	6	DS	18
508.2	Brown moist stiff SILTY CLAY.	17.0	15	I	4/5/8	7	DS	18
505.7	Brown, some tan moist stiff SILTY CLAY, with silt seams, partially varved.			I	2/3/4	8	DS	18
			20	I	3/3/3	9	DS	18
	Mottled brown and reddish brown moist medium stiff to stiff SILTY CLAY, trace iron oxide stains.			I	2/4/4	10	DS	18
			25	I	2/4/6	11	DS	18
494.7		28.0						

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman JS / TD-2
Surf. Elev. 522.7 ft. Hammer Drop 30 in. Rock Core Dia. -- in. Engineer LJC/TWV
Date Started 12/11/08 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 12/11/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 51.2 ft.
AT COMPLETION Dry ft.
AFTER 48 hrs. Surface Water ft.
BACKFILLED 8 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** SED 4 (2 of 2)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
492.7			30					
	Gray moist stiff SILTY CLAY, partially varved.			I	2/4/4	12	DS	18
			35	I	3/3/5	13	DS	18
489.7		38.0						
	Gray moist stiff SILTY CLAY (CH).		40	I	3/5/7	14	DS	18
479.7		43.0						
	Olive brown and gray moist very stiff CLAY.		45	I	4/5/8	15	DS	18
474.7		48.0						
	Olive brown, some brown moist stiff CLAY, varved.				Note: Scale Change			
			50	I	3/4/5	16	DS	18
469.7		53.0						
	Olive brown and gray moist very stiff SILTY CLAY, with limestone and shale fragments, trace fossils.		55	I	7/15/17	17	DS	18
459.7			60	I	27/10/14	18	DS	3
		63.0						
457.2	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	65.5	65	I	65/6"	19	DS	6
	Bottom of test boring at 65.5 feet.							

Datum MSL — Hammer Wt. 140 lbs. — Hole Diameter 8 in. — Foreman JS / TD-2

Surf. Elev. 522.7 ft. — Hammer Drop 30 in. — Rock Core Dia. -- in. — Engineer LJC/TWV

Date Started 12/11/08 — Pipe Size O.D. 2 in. — Boring Method 3-1/4" HSA — Date Completed 12/11/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 51.2 ft.
AT COMPLETION Dry ft.
AFTER 48 hrs. Surface Water ft.
BACKFILLED 8 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 8 (1 of 3)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
523.6	SURFACE	0.0						
	Mixed brown moist medium stiff FILL, silty clay, trace topsoil and hairlike roots.			I	2/2/3	1	DS	18
521.6		2.0						
	Mixed brown moist medium stiff to stiff FILL, silty clay with shale and limestone fragments and trace hairlike roots.			I	4/7/5	2	DS	10
			5	U		3	PT	23
				I	2/2/2	4	DS	18
514.1		9.5						
	Brown, trace tan and gray moist stiff SILTY CLAY, with silt and fine sand seams, varved.		10	I	2/4/4	5	DS	18
				I	2/4/3	6	DS	18
509.6		14.0						
	Brown, trace gray moist medium stiff SILTY CLAY, trace iron oxide stains and organic matter.		15	I	2/2/3	7	DS	18
506.6		17.0						
	Mottled brown and reddish brown moist stiff SILTY CLAY, trace iron oxide stains.			I	3/4/6	8	DS	18
504.1		19.5						
	Mottled light brown and brown moist medium stiff to stiff SILTY CLAY, with shale fragments and limestone floaters.		20	I	2/4/8	9	DS	18
				I	3/4/3	10	DS	18
			25	I	6/8/9	11	DS	3
495.6		28.0						

Datum	MSL	Hammer Wt.	140 lbs.	Hole Diameter	8 in.	Foreman	JS / TD-2
Surf. Elev.	523.6 ft.	Hammer Drop	30 in.	Rock Core Dia.	1-7/8 in.	Engineer	LJC/TWV
Date Started	12/17/08	Pipe Size	O.D. 2 in.	Boring Method	3-1/4" HSA	Date Completed	12/18/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED Trace 45/63 ft.
AT COMPLETION 22.2 ft.
AFTER 48 hrs. 25.3 ft.
BACKFILLED 12 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. **BORING #:** GAC 8 (2 of 3)

PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky **JOB #:** 081069E

LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (inches)
493.6			30					
	Brown, trace gray moist medium stiff to stiff SILTY CLAY, with silt and fine sand seams, varved.			I	2/4/6	12	DS	18
490.6		33.0						
	Gray moist medium stiff to stiff SILTY CLAY, with silt seams, varved (CL).		35	I	3/4/6	13	DS	18
			40	I	2/4/5	14	DS	18
			45	I	2/3/3	15	DS	18
475.6		48.0						
	Bluish gray and olive brown moist stiff CLAY.		50	I	3/5/7	16	DS	18
470.6		53.0						
	Mottled brown and gray moist very stiff SILTY CLAY, with randomly oriented shale fragments and limestone floaters.		55	I	4/6/20	17	DS	18

Datum	MSL	Hammer Wt.	140 lbs.	Hole Diameter	8 in.	Foreman	JS / TD-2
Surf. Elev.	523.6 ft.	Hammer Drop	30 in.	Rock Core Dia.	1-7/8 in.	Engineer	LJC/TWV
Date Started	12/17/08	Pipe Size	O.D. 2 in.	Boring Method	3-1/4" HSA	Date Completed	12/18/08

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS - DRIVEN SPLIT SPOON	FIRST NOTED Trace 45/63 ft.	HSA - HOLLOW STEM AUGERS
I - INTACT	PT - PRESSED SHELBY TUBE	AT COMPLETION 22.2 ft.	CFA - CONTINUOUS FLIGHT AUGERS
U - UNDISTURBED	CA - CONTINUOUS FLIGHT AUGER	AFTER 48 hrs. 25.3 ft.	DC - DRIVING CASING
L - LOST	RC - ROCK CORE	BACKFILLED 12 days	MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Malcolm Pirnie, Inc. BORING #: GAC 8 (3 of 3)
PROJECT: Geotechnical Exploration, Advanced Treatment Facilities, TMTP, Taylor Mill, Kentucky JOB #: 081069E
LOCATION OF BORING: As shown on Boring Plan, Drawing 081069E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
463.6	SURFACE		60					
460.6	Mottled brown and gray moist very stiff SILTY CLAY, with randomly oriented shale fragments and limestone floaters.	63.0		I	6/10/14	18	DS	18
455.1	Brown wet very dense silty fine to coarse SAND and GRAVEL.	68.5	65	I	22/42/37	19	DS	18
453.1	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	70.5	70		50/6"	20	DS	5
451.1	Interbedded gray moist, extremely weak to weak slightly weathered to unweathered thin to medium bedded calcareous SHALE and gray strong to very strong unweathered thin to medium bedded medium to coarse crystalline grained locally fossiliferous LIMESTONE. The limestone occurs in 1 to 3-inch beds and comprises 34.4 % of this interval. (Point Pleasant Formation Bedrock)	72.5	75		RQD = 25%	21	RC	24/24
441.1	Interbedded gray moist, extremely weak to weak slightly weathered to unweathered thin to medium bedded calcareous SHALE and gray strong to very strong unweathered thin to medium bedded medium to coarse crystalline grained locally fossiliferous LIMESTONE. The limestone occurs in 1 to 8-inch beds and comprises 37.5 % of this interval. (Point Pleasant Formation Bedrock)	82.5	80		RQD = 49%	22	RC	120/120
	Bottom of test boring at 82.5 feet.		85					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 8 in. Foreman JS / TD-2
Surf. Elev. 523.6 ft. Hammer Drop 30 in. Rock Core Dia. 1-7/8 in. Engineer LJC/TWV
Date Started 12/17/08 Pipe Size O.D. 2 in. Boring Method 3-1/4" HSA Date Completed 12/18/08

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED Trace 45/63 ft.
AT COMPLETION 22.2 ft.
AFTER 48 hrs. 25.3 ft.
BACKFILLED 12 days

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

G. J. Thelen, PSC

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☐ 1008 Marshall Ave./Cincinnati, Ohio 45225/513-681-2089

LOG OF TEST BORING

CLIENT Kenton County Water District — BORING # 1
PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky — JOB # 75126E
LOCATION OF BORING As shown on attached boring plan — (Page 1 of 2)

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
517.3	SURFACE	0.0						
516.3	Brown moist medium stiff FILL, silty clay with roots.	1.0		I	2/2/3	1	DS	14"
	Brown moist stiff FILL, silty clay, trace brick and cinder fragments (CL).			U	--	2	PT	11"
			5	I	2/3/4	3	DS	12"
510.3		7.0						
	Mottled brown, trace gray moist stiff FILL, silty clay with roots, cinders and foreign matter (CL).			U	--	4	PT	18"
			10	I	2/4/6	5	DS	15"
505.3		12.0						
502.8	Brown moist stiff FILL, silty clay with silt seams (CL).	14.5		U	--	6	PT	25"
500.3	Brown moist very stiff SILTY CLAY with cracks iron oxide stained, trace fine gravel.	17.0	15	I	4/6/9	7	DS	18"
	Brown moist very stiff SILTY CLAY, varved. Some cracks with iron oxide stains (CL).			U	--	8	PT	22"
				NOTE SCALE CHANGE				
			20	I	8/9/11	9	DS	18"
492.8		24.5						
	Mottled brown moist very stiff SILTY CLAY, varved.		25	I	6/7/10	10	DS	9"
487.8		29.5						
486.6	Brown moist stiff CLAY.	30.7	30	U	--	11	PT	24"
482.8	Gray moist stiff CLAY. (CH)	34.5	35					

Datum USGS — Hammer Wt. 140 Lbs. — Hole Diameter 10" — Foreman D.M.
Surf. Elev. 517.3 Ft. — Hammer Drop 30 In. — Rock Core Dia. NXM-2" — Engineer D.B.T.
Date Started 6/10/75 — Pipe Size O.D.2 In. — Boring Method HSA — Date Completed 6/10/75

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLER TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 61.8 FT.
AT COMPLETION * FT.
AFTER 6/27 14.0 FT.

BORING METHOD
HSA – Hollow Stem Augers
CFA – Continuous Flight Augers
DC – Driving Casing
MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen, PSC

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LOG OF TEST BORING

CLIENT Kenton County Water District — BORING # 1

PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky — JOB # 75126E

LOCATION OF BORING As shown on attached boring plan — (Page 2 of 2)

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	COND	Blows/6"	NO.	TYPE	REC.
	SURFACE	0.0		I	2/7/8	12	DS	18"
	Gray moist stiff SILTY CLAY, trace organic matter with silt seams. (CL)		40	U	--	13	PT	23"
469.3		48.0	45	I	3/4/6	14	DS	18"
462.8	Gray moist stiff SILTY CLAY with silt seams and organic odor. (CL)	54.5	50	U	--	15	PT	18"
459.3	Mottled olive brown and gray moist very stiff CLAY.	58.0	55	I	9/12/14	16	DS	18"
456.7	Gray moist stiff CLAY. (CH)	60.6	60	U	--	17	PT	14"
452.8	Mottled olive brown and gray moist stiff CLAY with brown and gray silt seams. (CH)	64.5	65	I	60/68/38	18	DS	18"
449.8	Brown wet very dense fine to coarse SAND and GRAVEL with limestone floaters.	67.5	70					
439.3	Gray moist soft to moderately tough SHALE and thinly bedded LIMESTONE. Limestone in ½ to 6½ inch layers, fossiliferous and jointed. 67% Shale, 33% limestone (bedrock).	78.0	75			19	RC	58"/120"
	Bottom of test boring at 78.0 feet.		80					
	* Piezometer set to a depth of 77.5 feet.							

Datum USGS — Hammer Wt. 140 Lbs. — Hole Diameter 10" — Foreman D.M.

Surf. Elev. 517.3 Ft. — Hammer Drop 30 In. — Rock Core Dia. NXM-2" — Engineer D.B.T.

Date Started 6/10/75 — Pipe Size O.D.2 In. — Boring Method HSA — Date Completed 6/10/75

SAMPLE CONDITIONS	SAMPLER TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 61.8 FT.	HSA – Hollow Stem Augers
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION * FT.	CFA – Continuous Flight Augers
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 6/27 14.0 FT.	DC – Driving Casing
L – LOST	RC – ROCK CORE		MD – Mud Drilling

CIVIL ENGINEERS

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LOG OF TEST BORING

CLIENT Kenton County Water District — BORING # 2

PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky — JOB # 75126E

LOCATION OF BORING As shown on attached boring plan — (Page 1 of 2)

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
482.2	SURFACE	0.0						
479.2	Mottled brown and dark brown moist very stiff FILL, silty clay with topsoil and roots.	3.0		I	2/4/5	1	DS	11"
477.7	Mottled brown moist stiff SILTY CLAY (possible fill).	4.5		I	5/5/6	2	DS	17"
475.2	Brown moist stiff SILTY CLAY, trace roots.	7.0	5	I	3/6/6	3	DS	17"
				I	3/2/3	4	DS	6"
			10	I	3/5/7	5	DS	16"
467.7	Mottled brown and gray moist stiff SILTY CLAY, trace roots, trace decomposed gravel.	14.5		I	2/1/3	6	DS	15"
466.7	Brown moist stiff SILTY CLAY, slightly sandy.	15.5	15					
465.2	Gray moist medium stiff to stiff SILTY CLAY with silt seams. (CL)	17.0		U	--	7	PT	25"
461.7	Layered gray moist medium stiff to stiff SILTY CLAY with silt seams, varved.	19.5		I	3/3/4	8	DS	18"
461.4	Brown and gray moist medium stiff SILTY CLAY. (CL)	20.8	20	U	--	9	PT	25"
460.2	Gray moist stiff SILTY CLAY.	22.0		I/	4/6/8	10	DS	18"
457.7	Gray moist stiff SILTY CLAY, trace organic matter.	24.5	25					
454.7	Dark gray moist stiff SILTY CLAY with gravel and rock fragments. (CL)	27.5		U	--	11	PT	19"

Datum USGS
Surf. Elev. 482.2 Ft.
Date Started 6/12/75

Hammer Wt. 140 Lbs.
Hammer Drop 30 In.
Pipe Size O.D.2 In.

Hole Diameter 10"
Rock Core Dia.
Boring Method HSA

Foreman D.M.
Engineer D?B.T.
Date Completed 6/12/75

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLER TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 16.0 FT.
AT COMPLETION * FT.
AFTER 6/27 22.0 FT.

BORING METHOD
HSA – Hollow Stem Augers
CFA – Continuous Flight Augers
DC – Driving Casing
MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen, PSC

☒ 618 Buttermilk Pike/Covington, Kentucky 41011/606-341-1322
☐ 1008 Marshall Ave./Cincinnati, Ohio 45225/513-681-2089

LOG OF TEST BORING

CLIENT Kenton County Water District BORING # 2
PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky JOB # 75126E
LOCATION OF BORING As shown on attached boring plan (page 2 of 2)

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
	SURFACE	0.0						
452.7	Brown and olive brown wet dense fine to coarse SAND and GRAVEL.	29.5		I	15/17/16	12	DS	6"
450.2	Olive brown, trace gray wet very dense fine to coarse GRAVEL and SAND with limestone floaters.	32.0	30	I	18/21/32	13	DS	16"
	Refusal on limestone. Bottom of test boring at 32.0 feet.			L	75/0"	14	DS	0"
			35					
	NOTE: 1.4 feet of fill placed prior to drilling to provide access for drill rig.							
	* Piezometer set to a depth of 32.0 feet.							

Datum USGS
Surf. Elev. 482.2 Ft.
Date Started 6/12/75

Hammer Wt. 140 Lbs.
Hammer Drop 30 In.
Pipe Size O.D.2 In.

Hole Diameter 10"
Rock Core Dia.
Boring Method HSA

Foreman D.M.
Engineer D.B.T.
Date Completed 6/12/75

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLER TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 16.0 FT.
AT COMPLETION * FT.
AFTER 6/27 22.0 FT.

BORING METHOD
HSA – Hollow Stem Augers
CFA – Continuous Flight Augers
DC – Driving Casing
MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen, PSC

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LOG OF TEST BORING

CLIENT Kenton County Water District — BORING # 3
PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky — JOB # 75126E
LOCATION OF BORING As shown on attached boring plan

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
~~469.0~~	SURFACE	0.0						
463.2	Brown moist medium stiff SILTY CLAY with roots.			I	1/1/1	1	DS	10"
459.5	Mottled brown to mottled brown and gray moist stiff SILTY CLAY with roots (CL).			I	2/3/4	2	DS	16"
456.0	Brown to mottled brown and gray moist stiff CLAY with fine sand and silt seams and roots (CH).	5.8	5					
454.5	Gray moist medium stiff SILTY CLAY with silt seams and organic matter.			U	--	3	PT	15"
453.8	Brown moist stiff SILTY CLAY, trace gravel.	9.5		I	2/4/4	4	DS	12"
452.0	Gray moist stiff SILTY CLAY, trace gravel and decomposed gravel (CL).		10	U	--	5	PT	13"
449.5	Olive gray moist very stiff SILTY CLAY, trace sand and fossils.	13.0		I	1/5/5	6	DS	17"
447.0	Olive brown, grayish brown and gray moist very stiff sandy SILTY CLAY, trace fine gravel (CL).	14.5						
444.5	Mottled gray and brown moist very stiff SILTY CLAY, varved.	15.2	15	U	--	7	PT	17"
443.5	Gray moist medium stiff SILTY CLAY with sand seams.	17.0		I	7/4/7	8	DS	2"
442.0	Olive brown and dark gray moist stiff SILTY CLAY, trace sand.	19.5	20					
		22.0		U	--	9	PT	22"
	Refusal on limestone. Bottom of test boring at 27.0 feet.	24.5		I	8/12/13	10	DS	17"
		25.5	25	I	5/14/60/2"	11	DS	8"
		27.0	27.5					

Datum USGS — Hammer Wt. 140 Lbs. — Hole Diameter 10" — Foreman D.M.
Surf. Elev. 469.0 Ft. — Hammer Drop 30 In. — Rock Core Dia. — Engineer D.B.T.
Date Started 6/12/75 — Pipe Size O.D.2 In. — Boring Method HSA — Date Completed 6/12/75

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLER TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 24.5 FT.
AT COMPLETION ____ FT.
AFTER 6/27 HRS. 4.3 FT.*

BORING METHOD
HSA – Hollow Stem Augers
CFA – Continuous Flight Augers
DC – Driving Casing
MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen, PSC

☒ 618 Buttermilk Pike/Covington, Kentucky 41011/606-341-1322
☐ 1008 Marshall Ave./Cincinnati, Ohio 45225/513-681-2089

LOG OF TEST BORING

CLIENT Kenton County Water District — BORING # 4

PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky — JOB # 75126E

LOCATION OF BORING As shown on attached boring plan — (Page 1 of 2)

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
515.1	SURFACE	0.0						
	Mottled brown and gray and dark brown moist medium stiff to stiff FILL, silty clay with topsoil, trace brick fragments (CL)			I	2/2/4	1	DS	8"
510.6		4.5		U	--	2	PT	11"
			5					
507.8	Mottled brown and gray moist stiff to medium stiff FILL, silty clay.	7.3		I	3/4/4	3	DS	7"
506.6	Olive brown and gray moist stiff FILL, silty clay with organic matter and cinder fragments. Seam of organic matter, twigs and acorns at 8.4 feet (CL).	8.5		U	--	4	PT	23"
			10					
503.3	Mottled brown and gray moist stiff FILL, silty clay with roots and organic matter, trace gravel and trace silt seams.	11.8		I	6/7/8	5	DS	17"
502.7	Brown, gray and black moist stiff FILL, silty clay.	12.4		U	--	6	PT	14"
		14.5	15					
500.6	Brown, trace light brown moist very stiff FILL, silty clay, with rock and shale fragments and silt seams (CL).			I	6/9/12	7	DS	8"
				U	--	8	PT	19"
					NOTE SCALE CHANGE			
495.6	Mottled brown, trace gray moist stiff SILTY CLAY with fine sand and silt seams at 6 degree angle. Varved with some irregular zones. Some cracks filled with fine roots (CL).	19.5	20	I	7/9/11	9	DS	18"
487.1	Mottled brown and gray moist stiff SILTY CLAY with reddish brown stains and varved seams.		25	I	4/6/7	10	DS	15"
		28.0	30	U	--	11	PT	23"
481.1	Mottled brown, trace gray moist stiff to very stiff SILTY CLAY with fine sand and silt seams. Seams are irregular and inclined at approximately 39 degrees (CL).	34.0	35					

Datum USGS — Hammer Wt. 140 Lbs. — Hole Diameter 10" — Foreman R.N.

Surf. Elev. 515.1 Ft. — Hammer Drop 30 In. — Rock Core Dia. — Engineer D.B.T.

Date Started 6/13/75 — Pipe Size O.D.2 In. — Boring Method HSA — Date Completed 6/13/75

SAMPLE CONDITIONS	SAMPLER TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 41.5 FT.	HSA – Hollow Stem Augers
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 57.5 FT.	CFA – Continuous Flight Augers
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 6/27 14.8 FT.*	DC – Driving Casing
L – LOST	RC – ROCK CORE		MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen, PSC

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LOG OF TEST BORING

CLIENT Kenton County Water District   BORING # 4
PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky   JOB # 75126E
LOCATION OF BORING As shown on attached boring plan   (Page 2 of 2)

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
	SURFACE	0.0						
	Gray moist medium stiff very SILTY CLAY.			I	4/3/6	12	DS	18"
477.1		38.0						
	Layered gray and brown moist stiff SILTY CLAY with fine sand and silt seams, varved (CL).		40	U	--	13	PT	24"
471.1		44.0						
	Olive brown and blue moist very stiff SILTY CLAY with shale fragments, limestone floaters and silt deposits.		45	I	9/11/20	14	DS	12"
465.1		50.0	50	I	4/7/8	15	DS	18"
	Brown, trace gray moist very stiff CLAY with slickensides and inclined structure.							
462.1		53.0						
	Gray moist stiff CLAY, varved.		55	I	3/3/5	16	DS	15"
457.1		58.0						
	Brown to olive brown wet very dense fine to coarse SAND, some gravel with cobbles and limestone floaters.		60	I	19/50/6"	17	DS	12"
449.8		65.3	65	I	60/3"	18	DS	0"
	Refusal on limestone. Bottom of test boring at 65.3 feet.		70					
	NOTE: 1.2 feet of topsoil and silty clay fill removed from surface prior to drilling to provide access for drill rig.							

Datum USGS   Hammer Wt. 140 Lbs.   Hole Diameter 10"   Foreman R.N.
Surf. Elev. 515.1 Ft.   Hammer Drop 30 In.   Rock Core Dia. ____   Engineer D.B.T.
Date Started 6/13/75   Pipe Size O.D.2 In.   Boring Method HSA   Date Completed 6/13/75

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLER TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 41.5 FT.
AT COMPLETION 57.5 FT.
AFTER 6/27 14.8 FT.

BORING METHOD
HSA – Hollow Stem Augers
CFA – Continuous Flight Augers
DC – Driving Casing
MD – Mud Drilling

CIVIL ENGINEERS

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LOG OF TEST BORING

CLIENT Kenton County Water District BORING # 5

PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky JOB # 75126E

LOCATION OF BORING As shown on attached boring plan (Page 1 of 2)

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
488.6	SURFACE	0.0						
486.6	Brown moist stiff FILL, silty clay with silt seams and roots, varved.	2.0		I	2/3/4	1	DS	12"
484.1	Brown moist medium stiff FILL, silty clay, trace limestone floaters.	4.5		I	4/4/2	2	DS	15"
481.6	Brown and gray moist medium stiff FILL, silty clay.	7.0	5	I	2/3/4	3	DS	6"
				I	2/3/4	4	DS	18"
476.6	Brown, trace gray moist stiff FILL, silty clay, trace brick and rock fragments.	12.0	10	I	2/2/4	5	DS	15"
475.3	Mottled brown with dark brown moist medium stiff FILL, silty clay with organic matter, roots, trace brick fragments.	15.3		I	2/3/4	6	DS	12"
471.6	Mottled brown and gray to brown moist stiff FILL, silty clay, trace shale and brick fragments (CL).	17.0	15	U	--	7	DS	17"
468.5	Olive brown and brown moist stiff to medium stiff FILL, silty clay with twigs and leaves.	20.1		I	4/4/7	8	DS	6"
467.6	Dark gray moist medium stiff very SILTY CLAY, trace organic matter (topsoil).	21.0 / 21.5	20	U	--	9	DS	24"
467.1	Mottled brown and gray moist medium stiff SILTY CLAY (CL).	24.5		I	6/9/10	10	DS	18"
464.1	Mottled brown and dark brown moist stiff SILTY CLAY.		25	U	--	11	PT	13"
461.6	Brown and gray moist very stiff SILTY CLAY (CL).	27.0						

Datum USGS | Hammer Wt. 140 Lbs. | Hole Diameter 10" | Foreman R.N.

Surf. Elev. 488.6 Ft. | Hammer Drop 30 In. | Rock Core Dia. | Engineer D.B.T.

Date Started 6/13/75 | Pipe Size O.D.2 In. | Boring Method HSA | Date Completed 6/13/75

SAMPLE CONDITIONS
- D – DISINTEGRATED
- I – INTACT
- U – UNDISTURBED
- L – LOST

SAMPLER TYPE
- DS – DRIVEN SPLIT SPOON
- PT – PRESSED SHELBY TUBE
- CA – CONTINUOUS FLIGHT AUGER
- RC – ROCK CORE

GROUND WATER DEPTH
- FIRST NOTED 34.0 FT.
- AT COMPLETION 31.5 FT.
- AFTER 6/27 * FT.

BORING METHOD
- HSA – Hollow Stem Augers
- CFA – Continuous Flight Augers
- DC – Driving Casing
- MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen, PSC

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LOG OF TEST BORING

CLIENT: Kenton County Water District — BORING #: 5

PROJECT: Field Survey, Existing Filtration Plant, Kenton County, Kentucky — JOB #: 75126E

LOCATION OF BORING: As shown on attached boring plan

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
	SURFACE	0.0						
459.1	Brown moist medium stiff to stiff SILTY CLAY with reddish brown stains.	29.5		I	4/5/7	12	DS	17"
456.6	Mottled brown moist stiff SILTY CLAY.	32.0	30	I	3/5/7	13	DS	14"
454.6	Mottled brown moist stiff SILTY CLAY with fine sand seams, irregularly varved.	34.0		I	5/5/7	14	DS	16"
450.8	Olive brown, trace blue wet fine to coarse SAND, little gravel with limestone floaters.	37.8	35	I	13/14/19	15	DS	15"
				I	30/3"	16	DS	3"
	Refusal on limestone. Bottom of test boring at 37.8 feet. NOTE: 0.2 feet of topsoil removed prior to drilling to provide access for drill rig.		40					

Datum: USGS — Hammer Wt.: 140 Lbs. — Hole Diameter: 10" — Foreman: R.N.

Surf. Elev.: 488.6 Ft. — Hammer Drop: 30 In. — Rock Core Dia.: — Engineer: D.B.T.

Date Started: 6/13/75 — Pipe Size: O.D.2 In. — Boring Method: HSA — Date Completed: 6/13/75

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLER TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 34.0 FT.
AT COMPLETION 31.5 FT.
AFTER 6/27 * FT.

BORING METHOD
HSA – Hollow Stem Augers
CFA – Continuous Flight Augers
DC – Driving Casing
MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen, PSC

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LOG OF TEST BORING

CLIENT Kenton County Water District — BORING # 6

PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky — JOB # 75126E

LOCATION OF BORING As shown on attached boring plan — (Page 1 of 2)

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	SAMPLE Blows/6"	SAMPLE NO.	SAMPLE TYPE	SAMPLE REC.
472.6	SURFACE	0.0						
470.6	Brown and dark brown moist medium stiff FILL, silty clay with wood pieces.	2.0		I	3/3/4	1	DS	7"
466.8	Brown moist medium stiff SILTY CLAY with roots, trace gravel and organic matter. (CL)	5.8	5	I	3/1/3	2	DS	15"
465.6	Mottled brown and gray moist stiff SILTY CLAY with roots and fine sand seams.	7.0		U	--	3	PT	17"
				I	2/4/4	4	DS	17"
463.1	Mottled brown and gray moist medium stiff very SILTY CLAY with silt seams, varved.	9.5	10					
461.8	Brown with gray moist medium stiff SILTY CLAY with wood pieces.	10.8		U	--	5	PT	18"
460.6	Gray moist medium stiff SILTY CLAY with silt seams and seams with concentrations of organic matter. Trace wood and shale fragments, varved (CL).	12.0	15	I	3/4/5	6	DS	18"
458.1	Gray moist stiff SILTY CLAY with organic matter.	14.5		U	--	7	PT	20"
455.6	Gray moist stiff SILTY CLAY with organic matter and roots. Wood pieces at 15.7 feet (CL).	17.0		I	2/4/5	8	DS	14"
453.1	Gray moist stiff SILTY CLAY, trace organic matter, layers varved.	19.5	20	I	--	9	PT	22"
452.0	Olive gray moist medium stiff SILTY CLAY, trace gravel.	20.6						
445.6	Mottled blush gray and olive brown moist stiff SILTY CLAY (CL).	27.0	25	I	5/9/11	10	DS	18"

Datum USGS — Hammer Wt. 140 Lbs. — Hole Diameter 10" — Foreman R.N.

Surf. Elev. 472.6 Ft. — Hammer Drop 30 In. — Rock Core Dia. — Engineer D.B.T.

Date Started 6/16/75 — Pipe Size O.D.2 In. — Boring Method HSA — Date Completed 6/16/75

SAMPLE CONDITIONS
- D – DISINTEGRATED
- I – INTACT
- U – UNDISTURBED
- L – LOST

SAMPLER TYPE
- DS – DRIVEN SPLIT SPOON
- PT – PRESSED SHELBY TUBE
- CA – CONTINUOUS FLIGHT AUGER
- RC – ROCK CORE

* Backfilled.

GROUND WATER DEPTH
- FIRST NOTED None FT.
- AT COMPLETION 30.0 FT.
- AFTER 6/27 1.5 *FT.

BORING METHOD
- HSA – Hollow Stem Augers
- CFA – Continuous Flight Augers
- DC – Driving Casing
- MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen, PSC

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☐ 1008 Marshall Ave./Cincinnati, Ohio 45225/513-681-2089

LOG OF TEST BORING

CLIENT Kenton County Water District — BORING # 6

PROJECT Field Survey, Existing Filtration Plant, Kenton County, Kentucky — JOB # 75126E

LOCATION OF BORING As shown on attached boring plan

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE COND	Blows/6"	NO.	TYPE	REC.
	SURFACE	0.0						
443.1	Mottled brown, gray and olive brown moist very stiff CLAY, trace sand and fossils.	29.5		I	6/10/16	11	DS	17"
440.6	Mottled brown with gray moist stiff SILTY CLAY with limestone floaters.	32.0	30	I	40/27/30	12	DS	9"
	Refusal on limestone. Bottom of test boring at 32.0 feet.		35					
	NOTE: 0.4 feet of topsoil removed prior to drilling to provide access for drill rig.							

Datum USGS — Hammer Wt. 140 Lbs. — Hole Diameter 10" — Foreman R.N.

Surf. Elev. 472.6 Ft. — Hammer Drop 30 In. — Rock Core Dia. — Engineer D.B.T.

Date Started 6/16/75 — Pipe Size O.D.2 In. — Boring Method HSA — Date Completed 6/16/75

SAMPLE CONDITIONS
- D – DISINTEGRATED
- I – INTACT
- U – UNDISTURBED
- L – LOST

SAMPLER TYPE
- DS – DRIVEN SPLIT SPOON
- PT – PRESSED SHELBY TUBE
- CA – CONTINUOUS FLIGHT AUGER
- RC – ROCK CORE

* Backfilled

GROUND WATER DEPTH
- FIRST NOTED None FT.
- AT COMPLETION 30.0 FT.
- AFTER 6/27 1.5 * FT.

BORING METHOD
- HSA – Hollow Stem Augers
- CFA – Continuous Flight Augers
- DC – Driving Casing
- MD – Mud Drilling

CIVIL ENGINEERS
G. J. Thelen & Associates, Inc.
516 Enterprise Drive/Covington, Kentucky 41017/606-341-1322

LOG OF TEST BORING

CLIENT Kenton County Water District No. 1 BORING # 1
PROJECT Geotechnical Services, Acid Tank Addition, Taylor Mill Treatment Plant JOB # 86079E
LOCATION OF BORING As shown on Drawing 86079E-1 /Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE Cond	Blows/6"	No.	Type	Rec.
524.9	SURFACE	0.0						
				I	1/2/3	1	DS	14"
522.9	Mixed brown, dark brown and gray moist medium stiff FILL, silty clay, trace grass and pieces of glass.	2.0						
				I	2/3/4	2	DS	14"
520.4	Mixed brown and gray moist medium stiff FILL, clay.	4.5	5					
				I	2/2/2	3	DS	18"
517.9	Mixed brown, grayish brown and gray moist soft FILL, silty clay, trace fine gravel and roots.	7.0						
				I	2/2/2	4	DS	16"
515.4	Mixed brown and gray moist medium stiff FILL, silty clay, trace gravel.	9.5	10					
				I	2/2/3	5	DS	16"
512.9	Mixed brown and gray moist soft to medium stiff FILL, silty clay.	12.0						
				I	2/2/3	6	DS	18"
510.4	Grayish brown, brown and gray moist medium stiff SILTY CLAY with clayey silt seams.	14.5	15					
				I	8/9/9	7	DS	18"
				U		8	PT	18"
504.9	Brown and gray moist stiff SILTY CLAY, trace iron oxide stains. (CL)	20.0	20		Note scale change			
				I	8/9/11	9	DS	15"
502.4	Brown moist medium dense clayey SILT with thin gray and brown varved silty clay seams.	22.5						
			25	I	7/8/12	10	DS	11"
498.4	Brown and gray moist stiff SILTY CLAY with silt seams, varved.	26.5						
		30.0	30	I	6/10/18	11	DS	18"
494.9	Dark brown and gray moist stiff SILTY CLAY with silt seams, trace gravel, varved.(CL)							
	Bottom of test boring at 30.0 feet.							

Datum USGS
Surf. Elev. 524.9 Ft.
Date Started 3/20/86

Hammer Wt. 140 Lbs.
Hammer Drop 30 In.
Pipe Size O.D. 2 In.

Hole Diameter 5"
Rock Core Dia.
Boring Method CFA

Foreman JM
Engineer TWV
Date Completed 3/20/86

SAMPLE CONDITIONS
D — DISINTEGRATED
I — INTACT
U — UNDISTURBED
L — LOST

SAMPLER TYPE
DS — DRIVEN SPLIT SPOON
PT — PRESSED SHELBY TUBE
CA — CONTINUOUS FLIGHT AUGER
RC — ROCK CORE

GROUND WATER DEPTH
FIRST NOTED None FT.
AT COMPLETION Dry FT.
AFTER - HRS. - FT.
BACKFILLED Immed. HRS.

BORING METHOD
HSA — Hollow Stem Augers
CFA — Continous Flight Augers
DC — Driving Casing
MD — Mud Drilling

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.

516 Enterprise Drive/Covington, Kentucky 41017/606-341-1322

LOG OF TEST BORING

CLIENT Kenton County Water District No. 1 BORING # 2

PROJECT Geotechnical Services, Acid Tank, Taylor Mill Plant, Taylor Mill, Ky. JOB # 86079E

LOCATION OF BORING As shown on Drawing 86079E-2

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE Cond	Blows/6"	No.	Type	Rec.
516.5	SURFACE	0.0						
515.5	CONCRETE.	1.0				1	RC	12"
	Brown and gray moist stiff to very stiff SILTY CLAY with silt seams and partings (varved). (CL)		1 2 3	U		2	PT	21"
512.5		4.0		I	8/13/18	3A 3B 3C	DS	18"
511.0	Brown and gray moist medium stiff to stiff SILTY CLAY with silt seams and partings and iron oxide stains (varved).	5.5	4 5	I	18/30/35	4A 4B 4C	DS	18"
	Bottom of test boring at 5.5 feet.		6					

NOTE

Datum USGS
Surf. Elev. 516.5 Ft.
Date Started 7/2/86

Hammer Wt. 35" Lbs.
Hammer Drop 30 In.
Pipe Size O.D.2 In.

Hole Diameter 2"
Rock Core Dia.
Boring Method Cont.S.S.

Foreman ML
Engineer TWV
Date Completed 7/2/86

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLER TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED None FT.
AT COMPLETION Dry FT.
AFTER ___ HRS. ___ FT.
BACKFILLED Immed. HRS.

BORING METHOD
HSA – Hollow Stem Augers
CFA – Continous Flight Augers
DC – Driving Casing
MD – Mud Drilling

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.

516 Enterprise Drive/Covington, Kentucky 41017/606-341-1322

LOG OF TEST BORING

CLIENT Kenton County Water District BORING # 1

PROJECT Geotechnical Exploration, Proposed Additions, Taylor Mill Treatment /Plant, Taylor Mill, Kentucky JOB # 87189E

LOCATION OF BORING As shown on Drawing 87189E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE Cond	Blows/6"	No.	Type	Rec.
523.1	SURFACE	0.2						
522.9	TOPSOIL.			I	5/5/5	1A 1B	DS	16"
521.1	Mixed brown moist very stiff FILL, clay with shale fragments and limestone floaters.	2.0						
518.6	Mixed brown and reddish brown moist stiff FILL, silty clay and clay, trace decayed leaves.	4.5		I	4/4/4	2	DS	16"
516.1	Brown and gray moist very stiff SILTY CLAY with slickensides, varved. (CL)	7.0	5	I	4/8/12	3	DS	16"
513.6	Brown, olive brown and gray moist stiff SILTY CLAY with silt seams, varved.	9.5		I	5/5/9	4	DS	18"
508.6	Brown and gray moist stiff SILTY CLAY with silt seams, varved.		10	I	Note: Scale Change 4/5/9	5	DS	18"
506.1	Brown and gray moist medium stiff to stiff SILTY CLAY with silt seams, varved. (CL)	14.5	15	I	6/8/12	6	DS	18"
		17.0		I	4/7/10	7	DS	18"
503.6	Brown, trace gray moist medium stiff SILTY CLAY, varved.	19.5	20	I	7/11/17	8	DS	18"
500.6	Brown and gray moist stiff SILTY CLAY with limestone fragments and fossils.	22.5		I	17/21/22	9	DS	16"
492.1	Brown and olive brown moist stiff SILTY CLAY with limestone floaters and fossils, varved.		25	I	16/28/22	10	DS	18"
490.6	Gray moist stiff SILTY CLAY with fossils and limestone floaters, varved. (CL)	31.0	30					
		32.5		I	18/18/18	11A 11B	DS	18"
484.1	Olive brown and gray moist stiff SILTY CLAY with shale fragments, limestone floaters and fossils.		35	I	18/18/20	12	DS	18"
482.7	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).	39.0						
		40.4	40	I	50/4"	13	DS	4"
	Refusal and bottom of test boring at 40.4 feet. Note: A Shelby tube sample (PT-14) was obtained in an offset hole from 5.0 to 7.0 feet. Recovery was 21 inches.		45					

Datum USGS Hammer Wt. 140 Lbs. Hole Diameter 8" Foreman MW

Surf. Elev. 523.1 Ft. Hammer Drop 30 In. Rock Core Dia. Engineer TWV

Date Started 5/26/87 Pipe Size O.D. 2 In. Boring Method HSA Date Completed 5/27/87

SAMPLE CONDITIONS
- D — DISINTEGRATED
- I — INTACT
- U — UNDISTURBED
- L — LOST

SAMPLER TYPE
- DS — DRIVEN SPLIT SPOON
- PT — PRESSED SHELBY TUBE
- CA — CONTINUOUS FLIGHT AUGER
- RC — ROCK CORE

GROUND WATER DEPTH
- FIRST NOTED 21.5 FT.
- AT COMPLETION FT.
- AFTER 24 HRS. 9.2 FT.
- BACKFILLED 24 HRS.

BORING METHOD
- HSA — Hollow Stem Augers
- CFA — Continous Flight Augers
- DC — Driving Casing
- MD — Mud Drilling

Note: Shelby tube samples PT-1 and PT-2 were obtained in an offset hole from 26.5'to 28.5 and 29.0'to 31.0'. Recoverie were 6.5 and 12 inches, respectively.

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.

516 Enterprise Drive/Covington, Kentucky 41017/606-341-1322

LOG OF TEST BORING

CLIENT Kenton County Water District BORING # 2

PROJECT Geotechnical Exploration, Proposed Additions, Taylor Mill Treatment JOB # 87189E

LOCATION OF BORING As shown on Drawing 87189E-1 / Plant, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	Cond	Blows/6"	No.	Type	Rec.
518.9	SURFACE	0.4						
518.5	TOPSOIL.	2.0		I	3/7/6	1A 1B	DS	14"
516.9	Mixed brown, trace gray moist very stiff FILL, silty clay and clay, trace gravel and hairlike roots.	7.0	5	I	5/5/6	2	DS	18"
				I	5/5/5	3	DS	16"
511.9	Mixed brown, trace gray moist medium stiff to stiff FILL, clay.		10	I	3/4/4	4	DS	16"
				I	2/3/5	5	DS	18"
500.3	Mixed bluish green, brown and black moist medium stiff FILL, silty clay and clay, trace brick fragments and decayed bits of wood, leaves, roots.	18.6	15	I	4/4/5	6	DS	16"
				I	3/3/4	7	DS	14"
		19.5	20	I	5/6/8	8A 8B	DS	18"
499.4	Mottled olive green and gray moist medium stiff to stiff SILTY CLAY.	22.5		I	5/7/8	9	DS	16"
496.4	Brown and gray moist stiff SILTY CLAY, varved.	27.5	25	I	26/10/13	10	DS	16"
491.4	Brown, olive brown and reddish brown, trace gray moist stiff SILTY CLAY, trace silt seams and gravel, varved.	32.5	30	I	10/16/20	11	DS	16"
486.4	Brown and gray moist very stiff SILTY CLAY with limestone fragments.	37.5	35	I	10/15/35	12	DS	18"
481.4	Olive green, brown and gray moist stiff SILTY CLAY with shale and limestone fragments, varved.		40	I	8/15/21	13	DS	10"
473.4	Gray, trace brown moist stiff SILTY CLAY with shale and limestone fragments.	45.5	45					
471.9	Gray and brown moist soft weathered SHALE and thinly bedded LIMESTONE (bedrock).	47.0		I	8/50/4"	14	DS	11"
471.4	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).	47.5		I	50/6"	15	DS	6"
			50					
	Refusal and bottom of test boring at 47.5 feet.							

Datum USGS Hammer Wt. 140 Lbs. Hole Diameter 8" Foreman MW/JM

Surf. Elev. 518.9 Ft. Hammer Drop 30 In. Rock Core Dia. ____ Engineer TWV

Date Started 5/28/87 Pipe Size O.D. 2 In. Boring Method HSA Date Completed 5/29/87

SAMPLE CONDITIONS	SAMPLER TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 21.5 FT.	HSA – Hollow Stem Augers
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 16.8 FT.	CFA – Continous Flight Augers
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 24 HRS. 8.4 FT.	DC – Driving Casing
L – LOST	RC – ROCK CORE	BACKFILLED 24 HRS.	MD – Mud Drilling

*STANDARD PENETRATION TEST – DRIVING 2" OD SAMPLER 1' WITH 140 # HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.

516 Enterprise Drive/Covington, Kentucky 41017/606-341-1322

LOG OF TEST BORING

CLIENT Kenton County Water District — BORING # 3

PROJECT Geotechnical Exploration, Proposed Additions, Taylor Mill Treatment / Plant, Taylor Mill, Kentucky — JOB # 87189E

LOCATION OF BORING As shown on Drawing 87189E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH
516.0	SURFACE	
515.8	TOPSOIL.	0.2
514.0	Mixed brown and gray moist stiff FILL, silty clay.	2.0
509.0	Brown and reddish brown moist stiff SILTY CLAY, trace iron oxide stains and silt seams.	7.0
506.5	Brown and reddish brown, trace gray moist medium stiff to stiff very SILTY CLAY with silt seams, varved.	9.5
501.5	Brown and reddish brown, trace gray moist stiff SILTY CLAY with silt seams, limestone fragments and floaters.	14.5
500.0	Brown, dark brown and reddish brown moist medium stiff SILTY CLAY with silt seams and limestone fragments.	16.0
493.5	Brown and olive brown moist stiff SILTY CLAY with shale fragments, limestone floaters and fossils	22.5
487.0	Olive brown and gray moist stiff SILTY CLAY with shale and limestone fragments and fossils.	29.0
485.1	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).	30.9
	Refusal and bottom of test boring at 30.9 feet.	

Note: Shelby tube samples (PT-12 and PT-13) were obtained in an offset hole from 7.0 to 9.0 and 12.0 to 14.0 feet. Recoveries were 23 and 8 inches, respectively.

DEPTH SCALE: 5, 10, 15, 20, 25, 30, 35, 40

SAMPLE

Cond	Blows/6"	No.	Type	Rec.
I	2/3/3	1A	DS	16"
		1B		
I	3/7/8	2	DS	18"
I	6/6/7	3	DS	18"
I	3/3/4	4	DS	18"
I	4/9/10	5	DS	16"
I	6/19/20	6	DS	16"
	Note: Scale Change			
I	6/15/16	7A	DS	18"
		7B		
I	11/13/16	8	DS	12"
I	15/50/3"	9	DS	16"
I	9/13/16	10	DS	16"
I	30/50/4"	11	DS	10"

Datum USGS — Hammer Wt. 140 Lbs. — Hole Diameter 8" — Foreman MW

Surf. Elev. 516.0 Ft. — Hammer Drop 30 In. — Rock Core Dia. — Engineer TWV

Date Started 5/27/87 — Pipe Size O.D. 2 In. — Boring Method HSA — Date Completed 5/28/87

SAMPLE CONDITIONS
- D — DISINTEGRATED
- I — INTACT
- U — UNDISTURBED
- L — LOST

SAMPLER TYPE
- DS — DRIVEN SPLIT SPOON
- PT — PRESSED SHELBY TUBE
- CA — CONTINUOUS FLIGHT AUGER
- RC — ROCK CORE

GROUND WATER DEPTH
- FIRST NOTED 14.0 FT.
- AT COMPLETION FT.
- AFTER 24 HRS. 3.0 FT.
- BACKFILLED 24 HRS.

BORING METHOD
- HSA — Hollow Stem Augers
- CFA — Continous Flight Augers
- DC — Driving Casing
- MD — Mud Drilling

*STANDARD PENETRATION TEST — DRIVING 2" OD SAMPLER 1' WITH 140 # HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.

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LOG OF TEST BORING

CLIENT Kenton County Water District BORING # 4

PROJECT Geotechnical Exploration, Proposed Additions, Taylor Mill Treatment JOB # 87189E

LOCATION OF BORING As shown on Drawing 87189E-2 /Plant, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE Cond	Blows/6"	No.	Type	Rec.
521.5	SURFACE	0.0						
519.5	Mixed brown and dark brown dry hard FILL, silty clay and clay, trace gravel.	2.0		I	6/7/7	1	DS	14"
514.5	Mixed brown, trace gray moist medium stiff FILL, silty clay and clay, trace leaves.			I	5/5/4	2	DS	18"
512.5	Mixed brown and dark gray moist stiff to medium stiff FILL, silty clay and clay, trace gravel.	7.0	5	I	3/3/2	3	DS	15"
509.5	Brown, trace gray moist stiff SILTY CLAY, trace silt seams, varved.	9.0		I	5/4/6	4	DS	16"
507.0	Brown, trace gray moist stiff very SILTY CLAY with silt seams.	12.0	10	I	7/9/9	5	DS	18"
502.0	Brown and gray moist stiff SILTY CLAY with silt seams, trace slickensides.	14.5		I	7/6/7	6	DS	18"
					Note: Scale		Change	
499.0	Brown and reddish brown moist medium stiff to stiff SILTY CLAY with silt seams, varved.	19.5	15	I	9/10/12	7	DS	18"
				I	7/8/10	8	DS	18"
494.0	Brown, reddish brown and olive brown moist very stiff SILTY CLAY with silt seams, varved.	22.5	20	I	4/4/4	9	DS	18"
	Brown and olive brown moist stiff SILTY CLAY with silt seams, varved.	27.5	25	I	8/9/11	10	DS	18"
			30	I	8/10/10	11	DS	18"
485.0		36.5	35	I	7/7/9	12	DS	18"
	Bottom of test boring at 36.5 feet.		40					

Datum USGS Hammer Wt. 140 Lbs. Hole Diameter 8" Foreman JM

Surf. Elev. 521.5 Ft. Hammer Drop 30 In. Rock Core Dia. ____ Engineer TWV

Date Started 5/29/87 Pipe Size O.D. 2 In. Boring Method HSA Date Completed 5/29/87

SAMPLE CONDITIONS	SAMPLER TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 12.0 FT.	HSA – Hollow Stem Augers
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION Dry FT.	CFA – Continous Flight Augers
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 3 HRS. Dry FT.	DC – Driving Casing
L – LOST	RC – ROCK CORE	BACKFILLED 3 HRS.	MD – Mud Drilling

*STANDARD PENETRATION TEST – DRIVING 2" OD SAMPLER 1' WITH 140 # HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.

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LOG OF TEST BORING

CLIENT Kenton County Water District BORING # 5

PROJECT Geotechnical Exploration, Proposed Additions, Taylor Mill Treatment JOB # 87189F

LOCATION OF BORING As shown on Drawing 87189F-2 / Plant, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE Cond	Blows/6"	No.	Type	Rec.
498.6	SURFACE	0.0						
496.6	Mixed brown moist stiff FILL, silty clay, trace sand and gravel.	2.0		I	4/5/6	1	DS	14"
491.6	Mixed brown, trace gray moist stiff FILL, silty clay and clay.			I	4/4/5	2	DS	18"
479.1	Mixed brown, trace gray moist medium stiff to stiff FILL, silty clay, trace pieces of decayed leaves, plant stems.	7.0	5	I	3/4/5	3	DS	16"
478.1	Mixed brown and dark gray moist medium stiff FILL, silty clay, trace pieces of broken concrete.			I	3/4/5	4	DS	15"
476.1	Brown moist very stiff SILTY CLAY.		10	I	4/4/5	5	DS	18"
470.6	Brown and olive brown, trace gray moist very stiff SILTY CLAY, trace silt seams, varved.			I	4/5/5	6	DS	18"
467.1	Gray moist stiff SILTY CLAY, trace silt seams, varved.		15	I	7/8/6	7	DS	16"
				I	4/4/5	8	DS	18"
	Bottom of test boring at 31.5 feet.	19.5			Note: Scale Change			
		20.5	20	I	6/8/10	9A 9B	DS	18"
		22.5	25	U		10	PT	19"
		28.0		I	8/10/12	11	DS	18"
		31.5	30	I	7/8/8	12	DS	18"
			35					

Datum USGS Hammer Wt. 140 Lbs. Hole Diameter 5" Foreman JM

Surf. Elev. 498.6 Ft. Hammer Drop 30 In. Rock Core Dia. Engineer TWV

Date Started 5/29/87 Pipe Size O.D. 2 In. Boring Method CFA Date Completed 5/29/87

SAMPLE CONDITIONS	SAMPLER TYPE	GROUND WATER DEPTH	BORING METHOD
D — DISINTEGRATED	DS — DRIVEN SPLIT SPOON	FIRST NOTED 24 FT.	HSA — Hollow Stem Augers
I — INTACT	PT — PRESSED SHELBY TUBE	AT COMPLETION Dry FT.	CFA — Continous Flight Augers
U — UNDISTURBED	CA — CONTINUOUS FLIGHT AUGER	AFTER - HRS. - FT.	DC — Driving Casing
L — LOST	RC — ROCK CORE	BACKFILLED Immed HRS.	MD — Mud Drilling

*STANDARD PENETRATION TEST — DRIVING 2" OD SAMPLER 1' WITH 140 # HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.

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LOG OF TEST BORING

CLIENT Kenton County Water District BORING # 6

PROJECT Geotechnical Exploration, Proposed Additions, Taylor Mill Treatment JOB # 87189E

LOCATION OF BORING As shown on Drawing 87189E-1 /Plant, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE Cond	Blows/6"	No.	Type	Rec.
517.5	SURFACE	0.2						
517.3	TOPSOIL.			I	3/3/4	1	DS	14"
	Mixed brown and gray moist stiff FILL, silty clay	2.5						
515.0	with hairlike							
	Mixed bluish green and gray moist medium stiff SILTY CLAY with decayed pieces of wood and roots (sediment).		5	I	2/3/3	2	DS	12"
510.0		7.5						
	Brown and gray moist medium stiff SILTY CLAY, trace gravel, sand seams and iron oxide stains.		10	I	5/6/8	3	DS	16"
			15	I	6/6/8	4	DS	18"
500.5		17.0						
	Brown, olive brown and gray moist stiff SILTY CLAY,			I	7/9/16	5	DS	16"
498.0	varved.	19.5			Note Scale Change			
	Brown, olive brown and gray moist stiff to very stiff SILTY CLAY with limestone fragments, trace fossils.		20	U		6	PT	10"
				I	24/35/44	7	DS	10"
			25	I	26/50/6"	8	DS	6"
				I	35/22/30	9	DS	14"
486.0		31.5	30	I	14/15/33	10	DS	16"
	Bottom of test boring at 31.5 feet.							

Datum USGS Hammer Wt. 140 Lbs. Hole Diameter 5" Foreman MW

Surf. Elev. 517.5 Ft. Hammer Drop 30 In. Rock Core Dia. Engineer TWV

Date Started 8/10/87 Pipe Size O.D.2 In. Boring Method CFA Date Completed 8/10/87

SAMPLE CONDITIONS
- D — DISINTEGRATED
- I — INTACT
- U — UNDISTURBED
- L — LOST

SAMPLER TYPE
- DS — DRIVEN SPLIT SPOON
- PT — PRESSED SHELBY TUBE
- CA — CONTINUOUS FLIGHT AUGER
- RC — ROCK CORE

GROUND WATER DEPTH
- FIRST NOTED 10.0 FT.
- AT COMPLETION 12.2 FT.
- AFTER 24 HRS. 3.2 FT.
- BACKFILLED 24 HRS.

BORING METHOD
- HSA — Hollow Stem Augers
- CFA — Continous Flight Augers
- DC — Driving Casing
- MD — Mud Drilling

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.
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LOG OF TEST BORING

CLIENT: Kenton County Water District — BORING #: 7
PROJECT: Geotechnical Exploration, Proposed Additions, Taylor Mill Treatment — JOB #: 87189E
LOCATION OF BORING: As shown on Drawing 87189E-1 — /Plant, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE Cond	Blows/6"	No.	Type	Rec.
519.8	SURFACE	0.0						
517.3	Mixed brown and gray moist stiff FILL, silty clay, trace topsoil and hairlike roots.	2.5		I	3/3/4	1	DS	8"
511.8	Mixed brown and bluish green moist medium stiff FILL, silty clay and clay, trace roots, twigs and limestone fragments.		5	L/D	3/4/6	2	DS CA	0"
508.8	Mixed brown and gray moist soft FILL, silty clay and clay.	8.0						
507.3	Mixed bluish green, black and dark gray moist medium stiff FILL, silty clay, trace limestone floaters, decayed wood, roots, grass.	11.0	10	I	2/3/3	3A 3B	DS	18"
502.3	Dark gray moist medium stiff SILTY CLAY with black organic flecks (sediment).	12.5						
497.8	Brown and gray moist medium stiff SILTY CLAY.		15					
496.8	Olive brown, brown and gray moist stiff SILTY CLAY, varved.	17.5		I	3/5/8	4	DS	14"
495.3	Gray moist stiff SILTY CLAY with silt and sand seams, varved.				Note: Scale Change			
491.3	Bluish gray and brown moist very stiff SILTY CLAY, trace fossils and limestone fragments.	22.0 / 23.0 / 24.5	20	I / I	4/6/8 / 7/16/14	5 / 6A 6B	DS / DS	18" / 18"
489.8	Olive brown, trace gray moist stiff SILTY CLAY with limestone fragments.	28.5 / 30.0	25 / 30	I / U / I	12/18/24 / — / 82/25/30	7 / 8 / 9	DS / PT / DS	16" / 16" / 18"
	Bottom of test boring at 30.0 feet.		35					

Datum: USGS — Hammer Wt.: 140 Lbs. — Hole Diameter: 8" — Foreman: MW
Surf. Elev.: 519.8 Ft. — Hammer Drop: 30 In. — Rock Core Dia.: — Engineer: TWV
Date Started: 8/12/87 — Pipe Size: O.D.2 In. — Boring Method: HSA — Date Completed: 8/12/87

SAMPLE CONDITIONS
D — DISINTEGRATED
I — INTACT
U — UNDISTURBED
L — LOST

SAMPLER TYPE
DS — DRIVEN SPLIT SPOON
PT — PRESSED SHELBY TUBE
CA — CONTINUOUS FLIGHT AUGER
RC — ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 21.5 FT.
AT COMPLETION 17.2 FT.
AFTER 2.5 HRS. 9.0 FT.
BACKFILLED 2.5 HRS.

BORING METHOD
HSA — Hollow Stem Augers
CFA — Continous Flight Augers
DC — Driving Casing
MD — Mud Drilling

*STANDARD PENETRATION TEST — DRIVING 2" OD SAMPLER 1' WITH 140 # HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS
G. J. Thelen & Associates, Inc.
516 Enterprise Drive/Covington, Kentucky 41017/606-341-1322

LOG OF TEST BORING

CLIENT Kenton County Water District BORING # 8
PROJECT Geotechnical Exploration, Proposed Additions, Taylor Mill Treatment JOB # 87189E
LOCATION OF BORING As shown on Drawing 87189E -2 /Plant, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	DEPTH SCALE	SAMPLE Cond	Blows/6"	No.	Type	Rec.
521.4	SURFACE	0.0						
518.9	Mixed brown and gray moist stiff SILTY CLAY with hairlike roots, trace gravel.	2.5		I	2/4/6	1	DS	14"
513.9	Brown and gray moist stiff CLAY with silt seams, varved.	7.5	5	I	6/10/14	2	DS	18"
499.4	Brown, olive brown and reddish brown, trace gray moist medium stiff SILTY CLAY with silt seams, varved.		10	I	5/8/7	3	DS	18"
					Note: Scale Change			
496.9	Brown and olive brown moist stiff SILTY CLAY with silt seams, varved.		15	I	10/11/12	4	DS	
494.4	Brown and olive brown moist medium stiff SILTY CLAY with silt seams, varved.	22.0	20	I	6/8/12	5	DS	16"
492.4	Brown and gray moist stiff very SILTY CLAY with sand and silt seams, varved.	24.5		I	9/12/16	6	DS	18"
		27.0	25	I	9/12/18	7	DS	18"
486.9	Gray and brown moist stiff SILTY CLAY with silt and sand seams, varved.	29.0		U		8	PT	17"
			30	I	12/14/16	9	DS	15"
484.9	Gray moist stiff SILTY CLAY with silt seams, varved.	34.5		I	11/14/17	10	DS	18"
		36.5	35	I	9/13/12	11	DS	18"
	Bottom of test boring at 36.5 feet.		40					

Datum USGS
Surf. Elev. 521.4 Ft.
Date Started 8/12/87
Hammer Wt. 140 Lbs.
Hammer Drop 30 In.
Pipe Size O.D.2 In.
Hole Diameter 8"
Rock Core Dia.
Boring Method HSA
Foreman MW
Engineer TWV
Date Completed 8/12/87

SAMPLE CONDITIONS
D — DISINTEGRATED
I — INTACT
U — UNDISTURBED
L — LOST

SAMPLER TYPE
DS — DRIVEN SPLIT SPOON
PT — PRESSED SHELBY TUBE
CA — CONTINUOUS FLIGHT AUGER
RC — ROCK CORE

GROUND WATER DEPTH
FIRST NOTED None FT.
AT COMPLETION Dry FT.
AFTER .5 HRS. Dry FT.
BACKFILLED .5 HRS.

BORING METHOD
HSA — Hollow Stem Augers
CFA — Continous Flight Augers
DC — Driving Casing
MD — Mud Drilling

*STANDARD PENETRATION TEST — DRIVING 2" OD SAMPLER 1' WITH 140 # HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS
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☐ 3337 Milverton Court/Cincinnati, Ohio 45248-2865/513-574-7137

LOG OF TEST BORING

CLIENT: Kenton County Water District — BORING #: I-1
PROJECT: Consulting Services, Slope Monitoring, Taylor Mill Plant, Taylor Mill, /Kentucky — JOB #: 90044E
LOCATION OF BORING: As shown on Drawing 90044E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRA. DEPTH	SAMPLE Cond	Blows/6"	No.	Type	Rec.
494.3	SURFACE	0.0					
489.8	Mixed brown and gray moist stiff FILL, silty clay and shale with gravel, pieces of limestone and asphalt.	4.5	I	7/13/17	1	DS	16"
482.3	Brown and gray moist medium stiff to stiff SILTY CLAY with silt seams, varved.	12.0	I	2/2/2	2	DS	16"
			I	5/7/9	3	DS	18"
476.8	Gray moist medium stiff SILTY CLAY with thin sand and silt seams.	17.5	I	3/4/4	4	DS	18"
465.8	Gray moist medium stiff to stiff SILTY CLAY with thin silt seams, varved.	28.5	I	3/4/7	5	DS	18"
			I	3/6/13	6	DS	18"
459.8	Gray, trace brown moist stiff to very stiff SILTY CLAY, trace limestone fragments and floaters.	34.5	I	7/8/9	7	DS	18"
			I	23/23/30	8	DS	18"
455.8	Brown and gray moist stiff CLAY, varved.	38.5	I	9/9/12	9	DS	18"
452.8	Brown wet very dense fine to coarse SAND and GRAVEL, trace cobbles and boulders.	41.5	I	10/22/31	10	DS	13"
447.3	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).	47.0	I	50/3"	11	DS	3"
	Bottom of test boring at 47.0 feet. Note: Slope inclinometer casing set to a depth of 47 feet.						

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55

Datum: USGS — Hammer Wt.: 140 Lbs. — Hole Diameter: 8" — Foreman: JM
Surf. Elev.: 494.3 Ft. — Hammer Drop: 30 In. — Rock Core Dia.: — Engineer: TWV
Date Started: 7/6/90 — Pipe Size: O.D. 2 In. — Boring Method: HSA — Date Completed: 7/8/90

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLER TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 38.5 FT.
AT COMPLETION 41.5 FT.
AFTER ___ HRS. ___ FT.
BACKFILLED ___ HRS.

BORING METHOD
HSA – Hollow Stem Augers
CFA – Continous Flight Augers
DC – Driving Casing
MD – Mud Drilling

*STANDARD PENETRATION TEST – DRIVING 2" OD SAMPLER 1' WITH 140 #. HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District — BORING # 101

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky — JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet
520.3	SURFACE	0.0
519.7	ASPHALT	0.6
517.1	Mixed brown and olive brown, trace gray moist stiff FILL, silty clay, trace sand and pieces of limestone.	3.2
513.3	Mixed brown and gray moist stiff FILL, silty clay and clay.	7.0
508.3	Mixed brown, gray and dark gray moist medium stiff to stiff FILL, silty clay, trace decayed roots.	12.0
505.8	Brown, trace gray moist stiff SILTY CLAY with wet silt seams, trace hairlike roots. (CL)	14.5
504.4	Brown trace gray moist stiff to medium stiff SILTY CLAY.	15.9
503.3	Brown and gray moist stiff SILTY CLAY.	17.0
500.8	Brown moist medium stiff SILTY CLAY, trace iron oxide stains.	19.5
495.3	Brown moist stiff to very stiff SILTY CLAY with silt seams, varved.	25.0
493.8	Gray, some brown moist stiff SILTY CLAY with silt seams, varved.	26.5
	Bottom of test boring at 26.5 feet.	

SAMPLE Cond	Blows/6"	No.	Type	Rec. inches
I	3/5/7	1	DS	13
I	4/6/8	2A 2B	DS	15
U		3	PT	16/24
I	3/4/6	4	DS	7
I	4/6/6	5	DS	10
I	4/6/7	6	DS	18
I	3/5/6	7	DS	16
I	4/5/7	8A 8B	DS	18
I	4/6/7	9	DS	18
I	4/7/12	10	DS	18
U		11	PT	19/24
I	5/7/9	12	DS	16

Datum USGS — Hammer Wt. 140 lbs. — Hole Diameter 5 in. — Foreman MW

Surf. Elev. 520.3 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer TWV

Date Started 6/3/97 — Pipe Size 2 O.D. in. — Boring Method CFA — Date Completed 6/3/97

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 20.0 ft.
AT COMPLETION 19.9 ft.
AFTER 24 hrs. 5.3 ft.
BACKFILLED 24 hrs.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 102 (1/2)

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
519.7	SURFACE	0.0						
517.7	Mixed brown and dark brown moist stiff FILL, silty clay, trace gravel and roots.	2.0		I	2/6/10	1	DS	15
515.2	Brown, trace gray moist stiff to very stiff CLAY, trace iron oxide stains. (CH)	4.5	5	I	5/10/11	2	DS	17
510.2	Brown and gray moist stiff to very stiff SILTY CLAY with silt seams, varved.	9.5		I	6/8/11	3	DS	18
				I	6/8/10	4	DS	16
505.2	Brown, trace gray moist medium stiff to stiff SILTY CLAY with wet silt lenses.	14.5	10	I	3/3/4	5	DS	18
				I	3/2/5	6	DS	18
502.7	Brown, trace gray moist stiff SILTY CLAY with fine sand seams, varved.	17.0	15	I	5/7/8	7	DS	18
500.2	Brown, trace gray moist stiff SILTY CLAY with wet silt seams, trace iron oxide stains.	19.5		I	4/8/11	8	DS	18
497.7	Brown and gray moist stiff to very stiff SILTY CLAY.	22.0	20	I	8/11/14	9	DS	18
492.7	Brown and gray moist stiff SILTY CLAY with silt seams, varved.	24.5		I	7/11/11	10	DS	18
490.9	Brown to greenish brown and gray moist stiff SILTY CLAY with silt seams, varved.	28.8	25	I	4/6/8	11	DS	18
	Gray moist stiff SILTY CLAY with silt seams, varved. (CL)			I	4/7/10	12A 12B	DS	18

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman MW

Surf. Elev. 519.7 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer TWV

Date Started 6/3/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 6/3/97

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 12.5 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 24. hrs. 19.7 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 24 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District — BORING # 102 (2/2)
PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky — JOB # 970209E
LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. inches
	CONT. FROM PG. 1		30					
	Gray moist stiff SILTY CLAY with silt seams,varved. (CL)			I	7/9/10	13	DS	16
				U		14	PT	24/24
483.2		36.5	35	I	8/10/12	15	DS	18
	Bottom of test boring at 36.5 feet.							
			40					
			45					
			50					
			55					
			60					
			65					
			70					
			75					
			80					
			85					

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman MW
Surf. Elev. 519.7 ft. Hammer Drop 30 in. Rock Core Dia. ______ in. Engineer TWV
Date Started 6/3/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 6/9/97

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 12.5 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 24 hrs. 19.7 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 24 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 103

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
519.3	SURFACE	0.0						
	Mixed brown moist very stiff FILL, silty clay, trace limestone floaters, brick fragments, gravel and hairlike roots.			I	2/5/7	1	DS	16
517.3		2.0		I	5/13/19	2A 2B	DS	18
	Brown and gray moist very stiff SILTY CLAY with iron oxide stains.		5					
514.8		4.5		I	5/7/9	3	DS	17
	Brown moist very stiff SILTY CLAY with silt seams, varved.							
512.3		7.0		I	5/5/8	4	DS	15
	Brown and gray moist medium stiff SILTY CLAY with clayey silt seams and iron oxide stains, varved.		10	I	4/5/5	5	DS	18
505.3		14.0		I	6/6/7	6	DS	18
	Bottom of test boring at 14.0 feet.		15					
			20					
			25					

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman MW

Surf. Elev. 519.3 ft. Hammer Drop 30 in. Rock Core Dia. ______ in. Engineer TWV/JMK

Date Started 6/9/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 6/9/97

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED None ft.
AT COMPLETION Dry ft.
AFTER ____ hrs. ____ ft.
BACKFILLED Immed. hrs.

BORING METHOD
HSA– HOLLOW STEM AUGERS
CFA– CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 104 (1/2)
PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E
LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet
516.7	SURFACE	0.0
514.7	Mixed brown and dark brown moist medium stiff to stiff FILL, silty clay and topsoil, little asphalt, pieces of concrete, medium to coarse sand and gravel.	2.0
512.2	Mixed brown, trace gray moist stiff FILL, silty clay and clay, trace fine to medium sand.	4.5
509.7	Mixed brown, trace gray moist medium stiff FILL, silty clay, trace medium sand.	7.0
507.2	Mixed brown and gray moist very stiff FILL, silty clay, trace decayed organic matter.	9.5
504.7	Mixed brown and gray moist stiff FILL, clay and silty clay, trace limestone pieces and decayed organic matter (previous varved lakebed clay).	12.0
503.9	Mixed brown and greenish brown moist stiff FILL, silty clay and clay, trace limestone pieces, coarse sand and decayed organic matter (previous varved lakebed clay).	12.8
499.7	Mixed brown, trace gray moist stiff FILL, silty clay and clay (previous lakebed clay).	17.0
497.9	Mixed gray and greenish brown moist medium stiff FILL, silty clay and clay (previous lakebed clay).	18.8
497.2	Mixed greenish brown, dark brown and gray moist stiff FILL, silty clay and topsoil with decayed leaves and twigs.	19.5
494.7	Greenish brown and gray moist stiff SILTY CLAY.	22.0
489.7	Brown, greenish brown and gray moist medium stiff SILTY CLAY with wet silt seams and iron oxide stain, varved.	27.0
487.2	Brown and orange brown moist stiff SILTY CLAY, trace sandy gravel, cobbles and iron oxide stains. (CL)	29.5
	Orange brown and brown moist stiff SILTY CLAY with silt seams, trace sand, gravel, cobbles, and iron oxide stains.	

Cond	Blows/6"	No.	Type	Rec. inches
I	2/10/10	1	DS	16
I	4/6/6	2	DS	13
I	3/4/4	3	DS	18
I	4/6/6	4	DS	18
I	4/6/7	5	DS	13
I	5/8/9	6A 6B	DS	18
I	4/7/8	7	DS	18
I	4/5/6	8A 8B	DS	18
I	5/8/9	9	DS	18
I	5/7/8	10	DS	16
I	5/7/7	11	DS	18
I	13/23/50	12	DS	16

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman MW
Surf. Elev. 516.7 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer TWK/JMK
Date Started 6/4/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 6/4/97

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 22.5 ft.
AT COMPLETION 20.7 ft.
AFTER ____ hrs. ____ ft.
BACKFILLED * hrs.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 104 (2/2)

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
	SURFACE	30.3	30					
	Orange brown and brown moist stiff SILTY CLAY with silt seams, trace sand, gravel and cobbles.			I	16/26/50/4"	13	DS	16
486.4			35					
	Bottom of test boring at 30.3 feet;							
	* Hole backfilled by dozer.		40					
			45					
			50					
			55					

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman MW

Surf. Elev. 516.7 ft. Hammer Drop 30 in. Rock Core Dia. ______ in. Engineer TWV/JMK

Date Started 6/4/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 6/4/97

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 22.5 ft.	HSA – HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 20.7 ft.	CFA – CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER ____ hrs. ____ ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED * hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 105 (1/2)

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
515.9	SURFACE	0.0						
513.9	Mixed brown moist stiff FILL, silty clay, trace brick fragments and decayed pieces of wood.	2.0		I	2/2/5	1	DS	10
511.4	Brown moist stiff SILTY CLAY, varved at an angle.	4.5		I	4/5/5	2	DS	17
508.9	Brown and gray moist very stiff SILTY CLAY with silt seams, varved.	7.0	5	I	5/8/8	3	DS	18
506.4	Brown moist stiff SILTY CLAY, varved.	9.5		I	4/7/9	4	DS	18
503.9	Brown moist very stiff SILTY CLAY with iron oxide stains and silt seams, varved. (CL)	12.0	10	U		5	PT	24/24
489.9	Brown, trace gray moist stiff to medium stiff SILTY CLAY with silt seams, varved.	17.0	15	I I	5/8/8 4/8/10	6 7	DS DS	18 18
493.9	Brown moist stiff SILTY CLAY, with silt seams and iron oxide stains, varved.	22.0	20	U I	 10/16/16	8 9	PT DS	10/24 2
488.4	Brown and dark brown, trace gray moist stiff SILTY CLAY with silt seams, trace iron oxide stains, varved.	27.5	25	I I	5/7/8 4/7/8	10 11	DS DS	18 16
	Gray, trace brown moist very stiff SILTY CLAY, varved.							

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman MW

Surf. Elev. 515.9 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer TWV/JMK

Date Started 6/5/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 6/5/97

SAMPLE CONDITIONS
- D – DISINTEGRATED
- I – INTACT
- U – UNDISTURBED
- L – LOST

SAMPLE TYPE
- DS – DRIVEN SPLIT SPOON
- PT – PRESSED SHELBY TUBE
- CA – CONTINUOUS FLIGHT AUGER
- RC – ROCK CORE

GROUND WATER DEPTH
- FIRST NOTED None ft.
- AT COMPLETION Dry ft.
- AFTER 24 hrs. 25.8 ft.
- BACKFILLED 24 hrs.

BORING METHOD
- HSA – HOLLOW STEM AUGERS
- CFA – CONTINUOUS FLIGHT AUGERS
- DC – DRIVING CASING
- MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District — BORING # 105 (2/2)

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky — JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. inches
	CONT. FROM PG. 1		30					
483.4	Gray, trace brown moist very stiff SILTY CLAY, varved.	32.5		I	4/8/11	12	DS	18
475.0	Gray and bluish gray moist stiff SILTY CLAY, varved		35	I	6/7/10	13	DS	17
473.4	Olive brown and bluish gray moist stiff SILTY CLAY.	40.9 42.5	40	I	4/8/10	14A 14B	DS	18
	Brown and gray moist very stiff SILTY CLAY, trace shale fragments. (CL)		45	I	12/16/20	15	DS	17
464.4		51.5	50	I	12/20/22	16	DS	7
	Bottom of test boring at 51.5 feet.		55					
			60					
			65					
			70					
			75					
			80					
			85					

Datum USGS — Hammer Wt. 140 lbs. — Hole Diameter 8 in. — Foreman MW

Surf. Elev. 515.9 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer TWV/JMK

Date Started 6/5/97 — Pipe Size 2 O.D. in. — Boring Method HSA — Date Completed 6/5/97

SAMPLE CONDITIONS
- D – DISINTEGRATED
- I – INTACT
- U – UNDISTURBED
- L – LOST

SAMPLE TYPE
- DS – DRIVEN SPLIT SPOON
- PT – PRESSED SHELBY TUBE
- CA – CONTINUOUS FLIGHT AUGER
- RC – ROCK CORE

GROUND WATER DEPTH
- FIRST NOTED None ft.
- AT COMPLETION Dry ft.
- AFTER 24 hrs. 25.8 ft.
- BACKFILLED 24 hrs.

BORING METHOD
- HSA – HOLLOW STEM AUGERS
- CFA – CONTINUOUS FLIGHT AUGERS
- DC – DRIVING CASING
- MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

CIVIL ENGINEERS

G. J. Thelen & Associates, Inc.

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☐ 1310 Kemper Meadow Drive, Suite 600 / Forest Park, Ohio 45240-1651 / 513-825-4350 / Fax 513-825-4756

LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 106
PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E
LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
515.0	SURFACE	0.0					
513.0	Mixed brown moist soft to medium stiff FILL, silty clay with grass, twigs, roots, bits of asphalt and limestone floaters.	2.0	I	2/2/4	1	DS	3
510.5	Mixed brown moist medium stiff FILL, silty clay, trace bits of wood, brick and asphalt.	4.5	I	4/3/6	2	DS	10
508.0	Mixed brown and dark brown moist soft to medium stiff FILL, silty clay, trace sand.	7.0	I	4/2/7	3	DS	13
505.5	Mixed brown and dark brown moist medium stiff to stiff FILL, silty clay, trace brick fragments.	9.5	I	3/4/7	4	DS	16
503.0	Mixed brown moist stiff FILL, silty clay (previous varved lakebed clay).	12.0	I	5/5/7	5	DS	18
501.8	Mixed brown and dark gray moist medium stiff FILL, silty clay, trace grass, twigs and shale fragments.	13.2	I	5/7/7	6A 6B	DS	17
448.0	Mixed brown moist stiff FILL, silty clay, trace shale fragments.	17.0	I	4/8/11	7	DS	18
495.5	Mixed brown, trace gray moist stiff FILL, silty clay (previous varved lakebed clay).	19.5	I	10/11/11	8	DS	13
493.5	Brown moist stiff SILTY CLAY with iron oxide stains and limestone floaters.	21.5	I	38/23/23	9	DS	18
	Bottom of test boring at 21.5 feet.						

Depth scale (feet): 5, 10, 15, 20, 25

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman MW
Surf. Elev. 515.0 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer TWV/JMK
Date Started 6/4/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 6/4/97

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 16.5 ft.
AT COMPLETION 16.3 ft.
AFTER 48 hrs. 5.2 ft.
BACKFILLED 48 hrs.

BORING METHOD
HSA– HOLLOW STEM AUGERS
CFA– CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District — BORING # 107 (1/2)

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky — JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
484.1	SURFACE	0.0						
		1.0		I	2/5/5	1A 1B	DS	18
483.1	Mixed brown and dark brown moist medium stiff FILL, silty clay and topsoil with pieces of wood, decayed plant matter and hairlike roots.	2.0						
				I	2/3/2	2	DS	13
482.1	Brown and dark brown moist very stiff SILTY CLAY, trace iron oxide stains.	5.6	5					
				I	2/2/3	3A 3B	DS	18
478.5	Mottled brown and gray moist medium stiff CLAY with iron oxide stains. (CH)	7.0						
		8.5		I	11/8/5	4A 4B	DS	18
477.1	Dark gray moist medium stiff very SILTY CLAY with iron oxide stains, trace decayed plant matter.		10	I	4/4/4	5	DS	18
475.6	Mottled brown moist stiff SILTY CLAY with limestone floaters and iron oxide stains.	12.5		I	4/8/11	6	DS	18
471.6	Mottled brown and gray moist stiff SILTY CLAY with iron oxide stains and concretions, trace fine sand seams.	17.0	15	U		7	PT	7/24
467.1	Bluish gray and olive brown moist very stiff CLAY, varved. (CH)	19.5		I	5/6/7	8	DS	18
464.6	Bluish gray and olive brown moist stiff CLAY, trace iron oxide stains.		20	I	5/6/6	9	DS	18
461.1	Brown and gray moist stiff CLAY, varved. (CH)	23.0		D	16/50/3"	10	DS	9
456.1	Brown and gray wet very dense fine to coarse SAND and GRAVEL with cobbles.	28.0	25	D	48/38/38	11	DS	12
	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).							

Datum	USGS	Hammer Wt.	140 lbs.	Hole Diameter	8 in.
Foreman	MW	Surf. Elev.	484.1 ft.	Hammer Drop	30 in.
Rock Core Dia.	in.	Engineer	TWV/JMK	Date Started	6/6/97
Pipe Size	2 O.D. in.	Boring Method	HSA	Date Completed	6/6/97

SAMPLE CONDITIONS
- D – DISINTEGRATED
- I – INTACT
- U – UNDISTURBED
- L – LOST

SAMPLE TYPE
- DS – DRIVEN SPLIT SPOON
- PT – PRESSED SHELBY TUBE
- CA – CONTINUOUS FLIGHT AUGER
- RC – ROCK CORE

GROUND WATER DEPTH
- FIRST NOTED 21.5 ft.
- AT COMPLETION 14.2 ft.
- AFTER 24 hrs. 2.6 ft.
- BACKFILLED 24 hrs.

BORING METHOD
- HSA– HOLLOW STEM AUGERS
- CFA– CONTINUOUS FLIGHT AUGERS
- DC – DRIVING CASING
- MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District — BORING # 107 (2/2)

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky — JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
	CONT. FROM PG. 1	30.3	30	I	50/3"	12	DS	2
453.8	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).		35					
	Split spoon refusal and bottom of test boring at 30.3 feet.		40					
			45					
			50					
			55					
			60					
			65					
			70					
			75					
			80					
			85					

Datum	USGS	Hammer Wt.	140 lbs.	Hole Diameter	8 in.
Surf. Elev.	484.1 ft.	Hammer Drop	30 in.	Rock Core Dia.	in.
Date Started	6/6/97	Pipe Size	2 O.D. in.	Boring Method	HSA

Foreman: MW
Engineer: TWV/JMK
Date Completed: 6/6/97

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 21.5 ft.
AT COMPLETION 14.2 ft.
AFTER 24 hrs. 2.6 ft.
BACKFILLED 24 hrs.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 108

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. inches
531.0	SURFACE	0.0						
529.0	Mixed brown and dark brown moist medium stiff FILL, silty clay and topsoil with hairlike roots, some sand and gravel.	2.0		I	3/9/9	1	DS	9
526.5	Mixed brown, little black moist stiff FILL, silty clay, little asphalt, sand and limestone floaters.	4.5	5	I	6/3/3	2	DS	13
				I	2/2/4	3	DS	10
519.5	Mixed brown and gray very moist medium stiff FILL, clay with shale fragments, some limestone floaters and asphalt, trace decayed organic matter.	11.5	10	I	2/9/12	4	DS	10
				I	2/2/4	5	DS	4
	Bottom of test boring at 11.5 feet.		15					
			20					
			25					

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman MW

Surf. Elev. 531.0 ft. Hammer Drop 30 in. Rock Core Dia: ___ in. Engineer TWV/JMK

Date Started 6/4/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 6/4/97

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED None ft.	HSA – HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA – CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 48 hrs. Dry ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 48 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 109

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
520.9	SURFACE							
520.1	ASPHALT.	0.8		I	6/6/4	1	DS	16
516.4	Mixed brown and gray moist medium stiff FILL, silty clay, some sand and gravel.	4.5		I	4/4/6	2	DS	18
513.9	Mixed greenish gray and brown moist medium stiff FILL, silty clay, trace sand and black organic matter.	7.0	5	I	3/3/4	3	DS	18
511.4	Mixed greenish gray and brown moist stiff FILL, silty clay, trace brick fragments.	9.5		I	3/4/6	4	DS	18
508.9	Mottled greenish gray moist stiff SILTY CLAY, trace hairlike roots.	12.0	10	I	4/4/6	5	DS	18
506.4	Brown and gray moist stiff SILTY CLAY.	14.5		I	5/5/5	6	DS	18
504.4	Brown and gray moist stiff SILTY CLAY with silt seams.	16.5	15	I	5/5/9	7	DS	18
	Bottom of test boring at 16.5 feet.		20					
			25					

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman EJ

Surf. Elev. 520.9 ft. Hammer Drop 30 in. Rock Core Dia. ___ in. Engineer TWV

Date Started 7/29/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 7/29/97

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 15.5 ft.	HSA – HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA – CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 4 hrs. 12.3 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 4 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 110

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
521.9	SURFACE	00.0						
	Mixed brown and gray moist soft to stiff FILL, silty clay with sand, gravel, brick fragments, bits of asphalt shingle, asphaltic concrete and portland cement concrete.			I	6/8/12	1	DS	14
				I	3/2/2	2	DS	16
			5	I	8/9/35	3	DS	10
512.4		9.5		I	50/2"	4	DS	2
509.9	Mixed brown and gray moist medium stiff FILL, silty clay, some sand and gravel, pieces of wood and carpet.	12.0	10	I	9/9/6	5	DS	8
507.4	Mottled brown and gray moist stiff SILTY CLAY.	14.5		I	4/5/6	6	DS	18
505.4	Olive brown to brown, trace gray moist stiff SILTY CLAY with sand and silt seams, varved.	16.5	15	I	6/7/8	7	DS	18
	Bottom of test boring at 16.5 feet.		20					
			25					

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman EJ

Surf. Elev. 521.9 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer TWV

Date Started 7/29/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 7/29/97

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED None ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 2.5 hrs. Dry ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 2.5 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District BORING # 111

PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky JOB # 970209E

LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
516.9	SURFACE	0.2						
516.7	TOPSOIL.	2.0		I	4/4/3	1	DS	18
514.9	Mixed brown moist stiff FILL, silty clay, trace brick fragments.			I	5/5/5	2	DS	18
	Brown and gray moist stiff SILTY CLAY, trace iron oxide stains.		5	I	5/6/8	3	DS	16
				I	7/8/9	4	DS	18
504.9		12.0	10	I	4/6/9	5	DS	18
	Brown and gray moist stiff SILTY CLAY with fine sand seams.			I	6/6/8	6	DS	18
500.4		16.5	15	I	8/9/11	7	DS	18
	Bottom of test boring at 16.5 feet.		20					
			25					

Datum USGS Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman EJ

Surf. Elev. 516.9 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer TWV

Date Started 7/29/97 Pipe Size 2 O.D. in. Boring Method CFA Date Completed 7/29/97

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED None ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 1.5 hrs. Dry ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 1.5 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water Service District — BORING # 112
PROJECT: Geotechnical Services, Proposed Chemical Building, Taylor Mill, Kentucky — JOB # 970209E
LOCATION OF BORING: As shown on Drawing 970209E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	Cond	Blows/6"	No.	Type	Rec. Inches
497.9	SURFACE	0.4					
497.5	TOPSOIL.		I	5/7/10	1A 1B	DS	18
490.9	Mixed brown and gray moist stiff FILL, silty clay, trace sand, fine gravel and twigs.	7.0	I	4/4/5	2	DS	18
			I	5/5/5	3	DS	18
488.4	Mixed brown and gray moist medium stiff FILL, silty clay, trace decayed leaves and twigs.	9.5	I	4/5/6	4	DS	18
485.4	Mottled brown and gray moist stiff SILTY CLAY, trace iron oxide stains and hairlike roots.	12.5	I	7/9/11	5	DS	16
481.4	Mottled brown moist medium stiff to stiff SILTY CLAY.	16.5	I	7/6/12	6	DS	18
			I	4/5/9	7	DS	18
	Bottom of test boring at 16.5 feet.						

Depth scale (feet): 5, 10, 15, 20, 25

Datum USGS — Hammer Wt. 140 lbs. — Hole Diameter 5 in. — Foreman EJ
Surf. Elev. 497.9 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer TWV
Date Started 7/29/97 — Pipe Size 2 O.D. in. — Boring Method CFA — Date Completed 7/29/97

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED None ft.
AT COMPLETION Dry ft.
AFTER ____ hrs. ____ ft.
BACKFILLED Immed. hrs.

BORING METHOD
HSA– HOLLOW STEM AUGERS
CFA– CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District BORING # 201(1of2)
PROJECT: Consulting Services, Filter-to-Waste Basin, Taylor Mill Treatment Plant/ JOB # 010563E
LOCATION OF BORING: As shown on Boring Plan, Drawing 010563E-1 /Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
522.9	SURFACE	0.0						
				I	6/9/22	1	DS	16
518.4	Mixed brown moist very stiff FILL, silty clay and topsoil, trace hairlike roots and limestone floaters.	4.5		I	14/9/10	2	DS	2
515.9	Mixed brown moist soft FILL, fine to coarse sandy clay, trace shale fragments.	7.0	5	I	2/2/3	3	DS	8
513.4	Mixed brown and gray moist medium stiff FILL, clay some decayed wood.	9.5		I	5/5/5	4	DS	18
510.9	Dark gray moist stiff FILL, silty clay with sand and gravel, trace glass fragments and organic odor.	12.0	10	U		5	PT	18/24
507.2	Mottled dark brown moist stiff SILTY CLAY with decayed leaves and wood (sediment).	15.7		I	5/6/9	6	DS	18
503.4	Mottled brown and gray moist medium stiff SILTY CLAY with fine sand and silt seams (CL).	19.5	15	I	5/6/17	7	DS	10
500.9	Brown moist soft to medium stiff SILTY CLAY with wet silty fine sand layers, trace iron oxide stains.	22.0		I	6/6/9	8	DS	18
498.4	Brown and gray moist stiff interbedded clay, silt and fine sand, with lenses of decayed leaves.	24.5	20	I	5/6/6	9	DS	18
494.9	Gray, trace mottled brown moist stiff CLAY.	28.0		I	11/13/16	10	DS	18
	Olive brown, trace gray moist very stiff CLAY, trace limestone floaters and isolated sand pockets (CH).		25	I	7/15/17	11	DS	18

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman JS
Surf. Elev. 522.9 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer RWF
Date Started 10/4/01 Pipe Size O.D. 2 in. Boring Method HSA Date Completed 10/5/01

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 4.5 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 7.4 ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 2 hrs. 6.9 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 2 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District BORING # 201(2of2)
PROJECT: Consulting Services, Filter-to-Waste Basin, Taylor Mill Treatment Plant/ JOB # 010563E
PROJECT LOCATION: As shown on Boring Plan, Drawing 010563E-1 /Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
	CONT. FROM PG. 1		30					
				I	29/27/50	12	DS	16
		33.0						
489.9	Olive brown, trace gray moist very stiff CLAY, trace limestone floaters and isolated sand pockets (CH).	37.8	35	I	67/6"	13	DS	6
485.1	Brown moist medium stiff to stiff CLAY with silt seams, some limestone floaters.	42.3	40	I	29/27/40	14	DS	14
480.6	Olive brown, trace gray moist stiff SILTY CLAY, trace limestone fragments and floaters.	48.0	45	I	12/29/50/5"	15	DS	11
474.9	Gray some brown moist soft highly weathered SHALE and thinly bedded LIMESTONE (bedrock).	50.5	50	I	57/6"	16	DS	6
472.4	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).		55					
	Split spoon refusal and bottom of test boring at 50.5 feet.		60					
			65					
			70					
			75					
			80					
			85					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman JS
Surf. Elev. 522.9 ft. Hammer Drop 30 in. Rock Core Dia. ___ in. Engineer RWF
Date Started 10/4/01 Pipe Size O.D.2 in. Boring Method HSA Date Completed 10/5/01

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 4.5 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 7.4 ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 2 hrs. 6.9 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 2 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District — BORING # 202(1of2)
PROJECT: Consulting Services, Filter-to-Waste Basin, Taylor Mill Treatment Plant/ — JOB # 010563E
LOCATION OF BORING: As shown on Boring Plan, Drawing 010563E-1 /Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
530.8	SURFACE	0.6						
530.2	GRAVEL.	2.0		I	25/27/16	1	DS	17
528.8	Mixed brown moist very stiff to hard FILL, silty clay with brick and limestone fragments, trace gravel.	4.5		I	9/12/9	2	DS	18
526.3	Mixed brown moist very stiff FILL, sandy silty clay, trace limestone floaters.	7.0	5	I	11/16/14	3	DS	18
523.8	Mottled brown, trace gray moist stiff very SILTY CLAY.	9.5		I	10/11/14	4	DS	18
521.3	Mottled brown, trace gray moist stiff very SILTY CLAY, trace silty fine sand seams.	12.0	10	I	9/15/16	5	DS	18
518.8	Brown, trace gray moist stiff CLAY, trace gray silt seams (varved).	13.7 / 14.5		I	5/7/11	6A 6B	DS	18
517.1	Brown very moist soft SILTY CLAY (CL).		15	I	11/11/11	7	DS	18
516.3	Mottled brown, trace gray moist stiff SILTY CLAY.	17.0		I	8/14/15	8	DS	18
513.8	Interbedded brown moist stiff SILTY CLAY and gray wet SILT (partially varved).		20	I	50/6"	9	DS	3
508.8	Brown moist soft clayey SILT with limestone floaters.	22.0		I	14/28/41	10	DS	18
506.3	Mottled orange and brown moist very stiff CLAY, trace limestone floaters, silt pockets and iron oxide stains.	24.5	25	I	6/10/11	11	DS	18
502.5	Brown moist very stiff CLAY, trace iron oxide stains (CH).	28.3						

Datum MSL — Hammer Wt. 140 lbs. — Hole Diameter 5 in. — Foreman JS
Surf. Elev. 530.8 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer RWF
Date Started 10/5/01 — Pipe Size O.D. 2 in. — Boring Method HSA — Date Completed 10/5/01

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 15.4 ft.
AT COMPLETION 18.9 ft.
AFTER ____ hrs. ____ ft.
BACKFILLED Immed. hrs.

BORING METHOD
HSA– HOLLOW STEM AUGERS
CFA– CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District — BORING # 202(2of2)

PROJECT: Consulting Services, Filter-to-Waste Basin, Taylor Mill Treatment Plant/ — JOB # 010563E

PROJECT LOCATION: As shown on Boring Plan, Drawing 010563E-1 /Taylor Mill, Kentucky

CONT. FROM PG. 1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	Cond	Blows/6"	No.	Type	Rec. inches
			30	I	22/50/1"	12	DS	3
493.2	Brown moist soft to medium stiff CLAY with limestone floaters, trace sandy silt lenses.	37.6	35	I	50/2"	13	DS	2
			40	I	14/19/34	14	DS	9
482.5	Olive brown and gray moist stiff SILTY CLAY with limestone and fossil fragments, trace limestone floaters.	48.3	45	I	22/50/2"	15	DS	7
477.5	Gray moist soft to medium stiff CLAY some limestone floaters, trace shale fragments.	53.3	50	I	58/6"	16	DS	5
475.3	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).	55.5	55	I	50/6"	17	DS	6
	Split spoon refusal and bottom of test boring at 55.5 feet.		60					
			65					
			70					
			75					
			80					
			85					

Datum MSL — Hammer Wt. 140 lbs. — Hole Diameter 5 in. — Foreman JS

Surf. Elev. 530.8 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer RWF

Date Started 10/5/01 — Pipe Size O.D.2 in. — Boring Method HSA — Date Completed 10/5/01

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 15.4 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 18.9 ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER ____ hrs. ____ ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED Immed. hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District — BORING # 101(1of2)
PROJECT: Consulting Services, Slope Monitoring, Taylor Mill Treatment Plant, Taylor Mill, KY. — JOB # 010777E
LOCATION OF BORING: As shown on Site Plan, Drawing 010777E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. inches
522.2	SURFACE	0.0						
	Mixed brown moist stiff FILL, silty clay and topsoil, trace hairlike roots.			I	2/2/3	1	DS	17
517.7		4.5		I	2/2/3	2	DS	4
	Mixed brown moist medium stiff FILL, clay some decayed wood and leaves.		5	I	2/3/3	3	DS	18
515.2		7.0						
512.7	Brown and dark gray moist stiff CLAY.	2.5		I	1/1/2	4	DS	18
510.2	Brown moist stiff CLAY with silt seams.	12.0	10	U		5	PT	14/24
507.7	Brown moist medium stiff clayey SILT.	14.5		I	4/4/5	6	DS	18
505.2	Brown, trace gray moist stiff SILTY CLAY, trace limestone floaters.	17.0	15	I	4/5/7	7	DS	18
	Brown moist stiff SILTY CLAY with silt and fine sand seams (partially varved).			I	2/2/3	8	DS	18
			20	U		9	PT	24/24
497.7		24.5		I	4/7/8	10	DS	16
494.2	Brown, some gray moist stiff CLAY, trace silt seams.	28.3	25	I	3/7/9	11	DS	18

Datum MSL — Hammer Wt. 140 lbs. — Hole Diameter 5 in. — Foreman JS
Surf. Elev. 522.2 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer RWF
Date Started 10/3/01 — Pipe Size O.D. 2 in. — Boring Method CFA — Date Completed 10/3/01

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 63.0 ft.
AT COMPLETION 59.2 ft.
AFTER 16 hrs. 59.1 ft.
BACKFILLED 16 hrs.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District BORING # 101(2of2)
PROJECT: Consulting Services, Slope Monitoring, Taylor Mill Treatment Plant, Taylor Mill, KY. JOB # 010777E
PROJECT LOCATION: As shown on Site Plan, Drawing 010777E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
	CONT. FROM PG. 1							
				U		12	PT	24/24
	Brown and brownish gray moist stiff CLAY with silt seams (partially varved).			I	6/6/9	13	DS	18
483.9			35	I	4/5/9	14	DS	18
479.9	Gray moist stiff SILTY CLAY, trace fine sand.	38.3						
			40	I	4/5/7	15	DS	18
	Interbedded brown and gray moist medium stiff to stiff SILTY CLAY (partially varved).	42.3		U		16	PT	20/24
477.2		45.0	45	I	18/12/19	17	DS	12
474.2	Gray and olive green moist very stiff SILTY CLAY with limestone floaters.	48.0						
			50	I	11/9/11	18	DS	15
469.2	Brown, trace gray moist very stiff SILTY CLAY with limestone floaters.	53.0						
			55	I	4/5/7	19	DS	18
463.9	Brown, trace gray moist stiff CLAY with slickensides (varved).	58.3						
			60	I	5/5/7	20	DS	18
458.9	Dark gray moist stiff CLAY, trace slickensides (varved).	63.3						
			65	I	48/50/6"	21	DS	18
454.2	Gray some brown wet very dense fine to coarse GRAVEL, little sand, trace silty clay and limestone fragments.	68.0						
		70.2	70	I	50/2"	22	DS	2
452.0	Gray moist soft SHALE and thinly bedded LIMESTONE (bedrock).							
			75					
	Bottom of test boring at 70.2 feet.		80					
	NOTE: An inclinometer casing was installed to the bottom of the test boring at 70.2 feet.		85					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman JS
Surf. Elev. 522.2 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer RWF
Date Started 10/3/01 Pipe Size O.D.2 in. Boring Method CFA Date Completed 10/3/01

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 63.0 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 59.2 ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 16 hrs. 59.1 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 16 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District — BORING # 101 (2of2)
PROJECT: Consulting Services, 36" Main Thrust Block, Taylor Mill, Kentucky — JOB # 050270E
PROJECT LOCATION: As shown on Boring Plan, Drawing 050270E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
	CONT. FROM PG. 1		30					
				I	3/5/8	12	DS	18
489.4	Brown moist stiff SILTY CLAY with silt seams and partings, varved.	33.0	35	I	3/4/6	13	DS	18
	Gray moist medium stiff to stiff SILTY CLAY with silt seams and partings, varved.		40	I	3/3/5	14	DS	18
			45	I	4/6/6	15	DS	18
469.4		53.0	50	I	2/2/4	16	DS	18
464.4	Olive brown moist very stiff CLAY with limestone fragments, varved.	58.0	55	I	2/5/7	17	DS	18
459.4	Gray moist medium stiff to stiff CLAY, trace limestone fragments, varved.	63.0	60	I	2/3/5	18	DS	18
451.4	Gray wet very sense silty fine to coarse SAND and GRAVEL.	71.0	65	D	15/20/50	19	DS	18
			70	D	17/80/6"	20	DS	10
450.9	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	71.5		I	60/6"	21	DS	6
	Bottom of test boring at 71.5 feet		75, 80, 85					
	*Note: Hole caved at 15 feet. Water at 13 feet.							

Datum MSL — Hammer Wt. 140 lbs. — Hole Diameter 7 in. — Foreman SW
Surf. Elev. 522.4 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer TWV
Date Started 4/17/05 — Pipe Size O.D.2 in. — Boring Method 3 1/4 HSA — Date Completed 4/18/05

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 13 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 57.8 ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 21.0 hrs. * ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 21.0 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District — BORING # 101 (1of2)
PROJECT: Consulting Services, 36" Main Thrust Block, Taylor Mill, Kentucky — JOB # 050270E
LOCATION OF BORING: As shown on Boring Plan, Drawing 050270E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
522.4	SURFACE	0.5						
521.9	Mixed dark brown moist stiff FILL, silty clay with some roots.			I	2/3/3	1A 1B	DS	18
	Brown, trace gray moist stiff to very stiff SILTY CLAY.			I	2/3/4	2	DS	18
515.4		7.0	5	I	2/3/5	3	DS	18
	Brown moist very stiff SILTY CLAY with silt seams and partings, varved.			I	2/3/7	4	DS	18
510.4		12.0	10	I	3/5/6	5	DS	18
	Brown moist medium stiff SILTY CLAY, varved with silt and sand seams.			I	4/2/3	6A 6B	DS	18
505.4		17.0	15	I	1/2/4	7	DS	18
	Brown moist stiff SILTY CLAY with silt seams and partings, varved.			I	2/4/7	8	DS	18
			20	I	4/4/6	9	DS	10
				I	2/4/7	10	DS	18
			25	L	2/5/6	11	DS	0

Datum MSL	Hammer Wt. 140 lbs.	Hole Diameter 7 in.	Foreman SW
Surf. Elev. 522.4 ft.	Hammer Drop 30 in.	Rock Core Dia. ____ in.	Engineer TWV
Date Started 4/17/05	Pipe Size O.D. 2 in.	Boring Method 3 1/4-HSA	Date Completed 4/18/05

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 13 ft.	HSA – HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 57.8 ft.	CFA – CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 21.0 hrs. * ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 21.0 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District BORING # 4
PROJECT: Geotechnical Exploration, 36" Water Main Relocation, Taylor Mill, Kentucky JOB # 050386E
LOCATION OF BORING: Station 4+89 (36"), Offset 10' Left

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet
473.9	SURFACE	0.0
471.9	Brown and light brown moist medium stiff SILTY CLAY with roots.	2.0
466.9	Brown moist very stiff SILTY CLAY, trace roots and iron oxide stains.	7.0
464.4	Mottled brown moist medium stiff to stiff SILTY CLAY, trace iron oxide stains.	9.5
459.4	Mottled brown, trace gray moist medium stiff to stiff SILTY CLAY, trace iron oxide stains.	14.5
456.9	Gray moist stiff layered SILTY CLAY, trace clay and fine sand layers.	17.0
456.0	Gray, trace brown moist medium stiff to stiff SILTY CLAY.	17.9
454.9	Gray moist medium stiff SILTY CLAY with limestone floaters.	19.0
451.9	Bluish gray moist stiff CLAY, trace fine sand and gravel.	22.0
445.9	Olive brown and gray moist stiff CLAY with shale fragments.	28.0
441.9	Gray, some brown very moist soft to medium stiff CLAY, trace fine sand with limestone floaters.	32.0
440.5	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	33.4
	Split spoon refusal and bottom of test boring at 33.4 feet.	

SAMPLE Cond	Blows/6"	No.	Type	Rec. inches
I	2/3/4	1	DS	18
I	3/3/4	2	DS	18
I	2/3/4	3	DS	18
I	2/2/3	4	DS	18
U		5	PT	18/24
I	2/2/3	6	DS	18
I	2/2/3	7	DS	18
U		8	PT	10/24
	Note: Scale Change			
I	2/4/6	9	DS	18
U		10	PT	24/24
I	3/4/6	11	DS	18
I	6/6/12	12	DS	15
I	80/4"	13	DS	4

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 7 in. Foreman SW
Surf. Elev. 473.9 ft. Hammer Drop 30 in. Rock Core Dia. ______ in. Engineer MES
Date Started 6/22/05 Pipe Size O.D. 2 in. Boring Method 3 1/4 HSA Date Completed 6/22/05

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 31.0 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 32.0 ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 24.0 hrs. 25.0 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 24.0 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District BORING # 5

PROJECT: Geotechnical Exploration, 36" Water Main Relocation, Taylor Mill, Kentucky JOB # 050386E

LOCATION OF BORING: As shown on Boring Plan, Drawing 050386E-1

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
482.8	SURFACE	0.0						
480.8	Mixed brown moist very stiff FILL, silty clay, trace roots and topsoil.	2.0		I	2/3/5	1	DS	18
475.8	Mottled brown and light brown moist very stiff SILTY CLAY, trace iron oxide stains.	7.0		I	3/6/11	2	DS	18
473.3	Mottled brown moist stiff to very stiff CLAY, trace iron oxide stains.	9.5	5	I	6/6/8	3	DS	18
470.8	Mottled brown and gray moist very stiff CLAY, trace iron oxide stains.	12.0						
468.3	Brown, trace gray moist stiff to very stiff SILTY CLAY, trace iron oxide stains.	14.5	10	I	3/4/5	4	DS	18
464.9	Brown, trace gray moist very stiff SILTY CLAY with clay layers (varved) (CL).	17.9		I	4/5/5	5	DS	18
463.7	Brown moist very stiff SILTY CLAY, trace fine sand.	19.1		I	2/3/4	6	DS	18
463.3	Gray moist medium stiff to stiff SILTY CLAY with silt and fine sand layers.	19.5	15	I	3/6/7	7	DS	18
460.8	Mottled gray moist stiff SILTY CLAY with silt and fine sand layers, trace organic matter.	22.0						
458.3	Olive brown and gray moist very stiff CLAY with shale fragments and limestone floaters.	24.5	20	U I	Note: Scale Change 2/3/5	8 9	PT DS	24/24 18
454.8	Olive brown and gray moist stiff SILTY CLAY, trace fine sand with shale fragments and limestone floaters (CL).	28.0	25	I I	2/13/50/0" 3/4/5	10 11	DS DS	10 18
449.8	Olive brown, brown and gray moist medium stiff SILTY CLAY, trace gravel and sand with limestone floaters.	33.0	30	I	15/16/20	12	DS	15
446.8	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	36.0	35	I	43/50/6"	13	DS	2
	Split spoon refusal and bottom of test boring at 36 feet.							

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 7 in. Foreman SW

Surf. Elev. 482.8 ft. Hammer Drop 30 in. Rock Core Dia. ______ in. Engineer MES

Date Started 6/22/05 Pipe Size O.D. 2 in. Boring Method 3 1/4 HSA Date Completed 6/22/05

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED 20.5 & 35.0 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 23.8 ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 24.0 hrs. 12.0 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 24.0 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District — BORING # 6

PROJECT: Geotechnical Exploration, 36" Water Main Relocation, Taylor Mill, Kentucky — JOB # 050386E

LOCATION OF BORING: Station 3+50 (36"), Offset 15' Left

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet
483.5	SURFACE	0.0
481.5	Mixed brown, some gray moist very stiff FILL, silty clay, trace shale fragments, trace fine to coarse sand with limestone floaters.	2.0
479.0	Mixed greenish brown moist very stiff FILL, silty clay, trace coarse sand, trace wood with limestone floaters.	4.5
476.5	Mixed brown, gray, some green moist stiff FILL, silty clay, trace organics and topsoil.	7.0
471.5	Mixed brown moist stiff FILL, silty clay, trace organics with limestone fragments.	12.0
469.0	Mottled brown, trace gray moist very stiff SILTY CLAY with iron oxide stains and limestone floaters.	14.5
467.0	Mottled olive brown, trace gray moist very stiff SILTY CLAY with iron oxide stains and limestone floaters.	16.5
	Bottom of test boring at 16.5 feet.	

DEPTH SCALE feet: 5, 10, 15, 20, 25

SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
I	5/9/13	1	DS	8
I	4/7/5	2	DS	10
I	4/3/6	3	DS	10
I	5/11/10	4	DS	12
I	4/6/19	5	DS	12
I	50/2"	6	DS	2
I	8/8/11	7	DS	10

Datum MSL — Hammer Wt. 140 lbs. — Hole Diameter 5 in. — Foreman GB

Surf. Elev. 483.5 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer MES

Date Started 8/4/05 — Pipe Size O.D. 2 in. — Boring Method CFA — Date Completed 8/4/05

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED None ft.
AT COMPLETION Dry ft.
AFTER – hrs. – ft.
BACKFILLED Immed. hrs.

BORING METHOD
HSA– HOLLOW STEM AUGERS
CFA– CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST — DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District — BORING #: 7

PROJECT: Geotechnical Exploration, 36" Water Main Relocation, Taylor Mill, Kentucky — JOB #: 050386E

LOCATION OF BORING: Station 2+11 (36"), Offset 2' Left

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet
507.3	SURFACE	0.0
505.3	Mixed brown moist very stiff FILL, silty clay with fine to coarse sand, limestone floaters and asphalt fragments.	2.0
502.8	Mixed brown, green and gray moist medium stiff FILL, silty clay, little clay with organics, trace coarse sand.	4.5
500.3	Mixed brown and brownish gray moist soft FILL, silty clay with some fine to coarse sand.	7.0
497.8	Mixed brown, green and black moist soft FILL, silty clay, trace fine to coarse sand and gravel with asphalt fragments and limestone floaters.	9.5
490.3	Mixed brown green and gray moist soft FILL, silty clay, trace fine to coarse sand, concrete fragments, glass, asphalt fragments and organics.	17.0
489.4	Greenish brown and gray moist medium stiff to stiff SILTY CLAY with organic stains (sediment).	17.9
487.8	Mottled brown and gray moist stiff to very stiff SILTY CLAY, trace hairlike roots.	19.5
485.8	Mottled brown and gray moist stiff SILTY CLAY with wet clayey silt layers.	21.5
	Bottom of test boring at 21.5 feet.	

SAMPLE

Cond	Blows/6"	No.	Type	Rec. Inches
I	18/25/16	1	DS	10
I	2/3/4	2	DS	8
I	2/2/4	3	DS	8
I	4/13/7	4	DS	8
I	3/3/3	5	DS	12
I	4/3/3	6	DS	10
I	3/4/3	7	DS	10
I	6/8/9	8A 8B	DS	13
I	5/6/11	9	DS	18

DEPTH SCALE feet: 5, 10, 15, 20, 25

Datum MSL — Hammer Wt. 140 lbs. — Hole Diameter 5 in. — Foreman GB

Surf. Elev. 507.3 ft. — Hammer Drop 30 in. — Rock Core Dia. ____ in. — Engineer MES

Date Started 8/4/05 — Pipe Size O.D. 2 in. — Boring Method CFA — Date Completed 8/4/05

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED 20.6 ft.
AT COMPLETION Trace ft.
AFTER 1.0 hrs. 15.3 ft.
BACKFILLED 1.0 hrs.

BORING METHOD
HSA– HOLLOW STEM AUGERS
CFA– CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District BORING #: 8

PROJECT: Geotechnical Exploration, 36" Water Main Relocation, Taylor Mill, Kentucky JOB #: 050386E

LOCATION OF BORING: Station 1+12 (36"), Offset 15' Right

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. inches
522.8	SURFACE	0.0						
	Mixed brown, trace greenish gray moist very stiff FILL, silty clay, trace topsoil, trace fine to coarse sand and fine gravel with limestone floaters, some cinders.			I	11/9/15	1	DS	12
518.3		4.5		I	7/8/18	2	DS	10
	Mixed brown, green and gray moist medium stiff FILL, silty clay, trace fine to coarse sand and organic stains, trace cinders.		5	I	5/5/5	3	DS	12
515.8		7.0						
513.3	Mixed green and brown moist soft FILL, silty clay with organics.	9.5		I	3/4/7	4	DS	12
	Mixed brown, green, trace gray moist soft FILL, silty clay with organics and concrete fragments.		10	I	3/4/6	5	DS	4
508.3		14.5		I	8/5/20	6	DS	12
505.8	Mixed brown, gray and green moist soft FILL, silty clay with fine to coarse sand and fine gravel, trace shale fragments with organics.	17.0	15	I	4/3/4	7	DS	8
503.3	Grayish brown, trace green moist stiff SILTY CLAY with trace roots (sediment).	19.5		I	7/9/10	8	DS	13
501.3	Mottled brown and olive gray moist stiff SILTY CLAY with limestone fragments.	21.5	20	I	18/12/13	9	DS	10
	Bottom of test boring at 21.5 feet. *Trace groundwater at 15.0 feet. Good groundwater at 20.0 feet.		25					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman GB
Surf. Elev. 522.8 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer MES
Date Started 8/4/05 Pipe Size O.D. 2 in. Boring Method CFA Date Completed 8/4/05

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED * ft.	HSA – HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION 19.3 ft.	CFA – CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER 2.0 hrs. 16.3 ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED 2.0 hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District BORING # 12
PROJECT: Geotechnical Exploration, Phase 2, 36" and 42" Water Mains, Taylor Mill, Kentucky JOB # 050386E
LOCATION OF BORING: Station 3+59 (42"), Offset 11' Right

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
530.6	SURFACE	0.0						
528.6	Mixed gray moist very dense FILL, fine to coarse crushed limestone.	2.0		D	50/4"	1	DS	2
523.6	Mixed brown moist very stiff FILL, silty clay, trace fine sand and topsoil with iron oxide stains.	7.0	5	I I	9/10/10 8/4/8	2 3	DS DS	8 13
521.1	Mixed brown moist stiff FILL, silty clay, trace topsoil.	9.5		I	7/9/7	4	DS	1
518.6	Mixed brown, trace greenish gray moist medium stiff FILL, silty clay, trace clay and topsoil.	12.0	10	I	4/5/4	5	DS	13
516.1	Brown to olive brown moist stiff SILTY CLAY with medium silt clayey silt layers.	14.5		I	3/4/5	6	DS	12
513.6	Mottled brown, trace olive gray moist very stiff SILTY CLAY with silt lenses (partially varved).	17.0	15	I	8/10/11	7	DS	13
511.6	Mottled brown, some olive gray moist stiff to very stiff SILTY CLAY with clayey silt layers.	19.0		I	6/8/7	8	DS	13
	Bottom of test boring at 19.0 feet.		20 25					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman BR
Surf. Elev. 530.6 ft. Hammer Drop 30 in. Rock Core Dia. ____ in. Engineer MES
Date Started 9/23/05 Pipe Size O.D. 2 in. Boring Method CFA Date Completed 9/23/05

SAMPLE CONDITIONS	SAMPLE TYPE	GROUND WATER DEPTH	BORING METHOD
D – DISINTEGRATED	DS – DRIVEN SPLIT SPOON	FIRST NOTED Trace 13.2 ft.	HSA– HOLLOW STEM AUGERS
I – INTACT	PT – PRESSED SHELBY TUBE	AT COMPLETION Dry ft.	CFA– CONTINUOUS FLIGHT AUGERS
U – UNDISTURBED	CA – CONTINUOUS FLIGHT AUGER	AFTER – hrs. – ft.	DC – DRIVING CASING
L – LOST	RC – ROCK CORE	BACKFILLED Immed. hrs.	MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: Northern Kentucky Water District BORING # 13

PROJECT: Geotechnical Exploration, Phase 2, 36" and 42" Water Mains, Taylor Mill, Kentucky JOB # 050386E

LOCATION OF BORING: Station 3+87 (42"), Offset 8' Right

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH feet	DEPTH SCALE feet	SAMPLE Cond	Blows/6"	No.	Type	Rec. Inches
529.3	SURFACE	0.0						
527.3	Mixed gray moist very dense FILL, crushed limestone.	2.0		D	50/6"	1	DS	3
524.8	Mixed brown, trace green moist very stiff FILL, silty clay, trace topsoil with glass.	4.5		I	4/8/9	2	DS	12
522.3	Mixed brown moist very stiff FILL, silty clay, trace fine sand.	7.0	5	I	6/6/6	3	DS	12
519.8	Mixed brown moist stiff FILL, silty clay, trace fine sand with limestone floaters.	9.5		I	8/6/5	4	DS	4
517.3	Mixed brown moist medium stiff to stiff FILL, silty clay, trace clay and trace topsoil, trace fine to medium sand.	12.0	10	I	3/4/6	5	DS	12
	Mottled brown, olive gray moist very stiff SILTY CLAY with silt lenses (partially varved).			I	4/6/7	6	DS	14
512.8		16.5	15	I	5/8/12	7	DS	18
	Bottom of test boring at 16.5 feet.		20					
			25					

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 5 in. Foreman BR

Surf. Elev. 529.3 ft. Hammer Drop 30 in. Rock Core Dia. ___ in. Engineer MES

Date Started 9/23/05 Pipe Size O.D. 2 in. Boring Method CFA Date Completed 9/23/05

SAMPLE CONDITIONS
D – DISINTEGRATED
I – INTACT
U – UNDISTURBED
L – LOST

SAMPLE TYPE
DS – DRIVEN SPLIT SPOON
PT – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
FIRST NOTED None ft.
AT COMPLETION Dry ft.
AFTER – hrs. – ft.
BACKFILLED Immed. hrs.

BORING METHOD
HSA– HOLLOW STEM AUGERS
CFA– CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

STANDARD PENETRATION TEST – DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: CH2M **BORING # :** 301 (1of2)

PROJECT: Geotechnical Exploration, Sludge Building Addition at NKWD Taylor Mill Treatment Plant, **JOB # :** 060581E

LOCATION OF BORING: As shown on Boring Plan, Drawing 060581E-1 /Grand Avenue, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
523.0	SURFACE	0.0						
522.3	CONCRETE	0.7						
521.9	Mixed brown moist medium dense FILL, silty fine sand, trace fine gravel with limestone fragments.	1.1		D/I	11/12/13	1A 1B	DS	12
520.7	Mixed brown, trace gray moist stiff FILL, silty clay, some sand, little fine gravel with limestone fragments.	2.3		D	9/11/6	2	DS	13
			5	U		3	PT	15/15
517.0	Mixed brown moist medium dense FILL, clayey fine sand with silty clay to coarse gravel and silty clay layers.	6.0		D	23/17/23	4	DS	18
511.0	Mixed brown moist dense FILL, very silty fine sand with fine to coarse gravel, some silty clay.	12.0	10	D	41/18/19	5	DS	13
508.5	Mixed brown moist medium dense FILL, stiff to stiff, some fine to coarse gravel.	14.5		D	17/7/5	6	DS	6
			15	D	13/7/10	7	DS	6
503.5	Mixed brown moist medium dense FILL, silty fine sand, little fine gravel.	19.5		I	9/6/9	8	DS	2
501.0	Brown, trace gray moist stiff SILTY CLAY with limestone floaters (partially layered).	22.0	20	I	5/6/10	9	DS	3
498.5	Brown, trace gray moist medium stiff to stiff SILTY CLAY.	24.5		I	2/5/6	10	DS	10
			25	I	7/14/22	11	DS	13
493.5	Brown, some orangish brown moist very stiff CLAY with limes tone floaters, trace fossil fragments.	29.5		I	6/28/27	12	DS	12

Datum	MSL	Hammer Wt.	140 lbs.	Hole Diameter	7" in.
Surf. Elev.	523.0 ft.	Hammer Drop	30 in.	Rock Core Dia.	- in.
Date Started	9/20/06	Pipe Size	O.D. 2 in.	Boring Method	3-1/4 HSA

Foreman: GB
Engineer: MES
Date Completed: 9/20/06

SAMPLE CONDITIONS	SAMPLE TYPE	GROUNDWATER DEPTH	BORING METHOD
D - DISINTEGRATED	DS -DRIVEN SPLIT SPOON	FIRST NOTED 15.0 ft.	HSA -HOLLOW STEM AUGERS
I -INTACT	PT -PRESSED SHELBY TUBE	AT COMPLETION 44.0 ft.	CFA -CONTINUOUS FLIGHT AUGERS
U -UNDISTURBED	CA -CONTINUOUS FLIGHT AUGER	AFTER 20.75 hr * ft.	DC -DRIVING CASING
L -LOST	RC -ROCK CORE	BACKFILLED 20.75 hrs.	MD -MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: CH2M Hill **BORING #:** 301 (2 of 2)

PROJECT: Geotechnical Exploration, Sludge Building Addition at NKWD Taylor Mill Treatment Plant. **JOB #:** 060581E

LOCATION OF BORING: As shown on Boring Plan, Drawing 060581E-1 /Grand Avenue, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	DEPTH SCALE (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (Inches)
	SURFACE	0.0						
490.0	Brown moist medium stiff to stiff CLAY with limestone floaters and shale fragments, trace fossil fragments.	33.0		I	21/22/27	13	DS	14
484.0	Brown wet medium stiff to stiff CLAY with shale fragments, limestone floaters, trace fossil fragments.	39.0	35	I	28/27/40	14	DS	3
480.0	Interbedded brown, some gray moist very soft highly weathered SHALE and gray hard LIMESTONE (bedrock).	43.0	40	I	50/6"	15	DS	4
477.5	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	45.5	45	I	50/6"	16	DS	4
	Split spoon refusal and bottom of test boring at 45.5 feet.							
	* Caved at 11.7 feet.		50					
			55					

Datum	MSL	Hammer Wt.	140 lbs.	Hole Diameter	7" in.
Foreman	GB	Surf. Elev.	523.0 ft.	Hammer Drop	30 in.
Rock Core Dia.	- in.	Engineer	MES	Date Started	9/20/06
Pipe Size	O.D. 2 in.	Boring Method	3-1/4 HSA	Date Completed	9/20/06

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED 15.0 ft.
AT COMPLETION 44.0 ft.
AFTER 20.75 hr * ft.
BACKFILLED 20.75 hrs.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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☑ 1398 Cox Avenue / Erlanger, Kentucky 41018-1002 / 859-746-9400 / Fax 859-746-9408
○ 2140 Waycross Road / Cincinnati, Ohio 45240-2719 / 513-825-4350 / Fax 513-825-4756
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LOG OF TEST BORING

CLIENT: CH2M Hill **BORING #:** 302

PROJECT: Geotechnical Exploration, Sludge Building Addition at NKWD Taylor Mill Treatment Plant, **JOB #:** 060581E

LOCATION OF BORING: As shown on Boring Plan, Drawing 060581E-1 /Grand Avenue, Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)
523.7	SURFACE	0.0
523.5	TOPSOIL	0.2
521.7	Mixed brown moist medium stiff FILL, silty clay with limestone floaters, trace hairlike roots.	2.0
519.2	Mixed brown, trace black moist very stiff FILL, silty clay with asphalt fragments, concrete fragments and limestone floaters.	4.5
517.2	Mixed brown, trace gray and green moist stiff FILL, silty clay, trace fine to coarse gravel, brick fragments, asphalt fragments and limestone floaters (CL).	6.5
514.2	Mixed greenish gray, trace brown moist medium stiff FILL, silty clay with concrete fragments and limestone floaters.	9.5
509.7	Brown, trace gray moist stiff to very stiff SILTY CLAY, trace hairlike roots (partially layered).	11.8
499.2	Brown, trace olive brown moist very stiff SILTY CLAY with shale fragments and limestone floaters (colluvium) (CL).	
496.7	Interbedded brown to olive brown, trace gray moist soft weathered SHALE and gray hard LIMESTONE (bedrock).	24.5
495.9	Interbedded gray moist soft SHALE and gray hard LIMESTONE (bedrock).	27.0
	Split spoon refusal and bottom of test boring at 27.8 feet.	27.8

SAMPLE

Cond	Blows/6"	No.	Type	Rec. (Inches)
I	2/3/4	1A 1B	DS	10
I	26/17/22	2	DS	8
U		3	PT	13/24
I	50/6"	4	DS	6
I	4/8/7	5	DS	10
U		6	PT	12/24
I	4/9/11	7	DS	13
I	50/6"	8	DS	1
I	7/50/6"	9	DS	7
L	17/20/22	10	DS	0
I	50/6"	11	DS	6
I	50/3"	12	DS	2

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 7" in. Foreman GB

Surf. Elev. 523.7 ft. Hammer Drop 30 in. Rock Core Dia. - in. Engineer MES

Date Started 9/20/06 Pipe Size O.D. 2 in. Boring Method 3-1/4 HSA Date Completed 9/20/06

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED None ft.
AT COMPLETION Dry ft.
AFTER 16.5 hr Dry ft.
BACKFILLED 16.5 hrs.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST - DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS

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LOG OF TEST BORING

CLIENT: CH2M Hill **BORING #:** 303

PROJECT: Geotechnical Exploration, New Building at NKWD Taylor Mill Treatment Plant, Grand Avenue, **JOB #:** 060581E

LOCATION OF BORING: As shown on Boring Plan, Drawing 060581E-1 /Taylor Mill, Kentucky

ELEV.	SOIL DESCRIPTION COLOR, MOISTURE, DENSITY, PLASTICITY, SIZE, PROPORTIONS	STRATA DEPTH (feet)	SAMPLE Cond	Blows/6"	No.	Type	Rec. (inches)
522.1	SURFACE	0.0					
517.6	Mixed brown moist very stiff FILL, silty clay, trace topsoil with hairlike roots, limestone fragments and asphalt fragments.	4.5	I	4/10/13	1	DS	13
			I	50/2"	2	DS	2
515.1	Mixed brown moist medium stiff to stiff FILL, silty clay, little fine sand, trace fine to coarse gravel with limestone fragments.	7.0	I	5/7/8	3	DS	2
512.6	Mixed brown moist stiff to very stiff FILL, silty clay with concrete and brick fragments.	9.5	I	4/25/10	4	DS	2
510.1	Mixed brown, trace green and gray moist very stiff FILL, silty clay, trace fine gravel, trace organic matter with glass pieces and brick fragments.	12.0	I	7/13/12	5	DS	12
508.1	Mixed brown, trace green and gray moist stiff FILL, silty clay, trace topsoil, trace fine gravel, cinders and brick fragments.	14.0	I	2/5/8	6	DS	8
	Bottom of test boring at 14.0 feet.						

Depth scale (feet): 5, 10, 15, 20, 25

Datum	MSL	Hammer Wt.	140 lbs.	Hole Diameter	7" in.	Foreman	GB
Surf. Elev.	522.1 ft.	Hammer Drop	30 in.	Rock Core Dia.	- in.	Engineer	MES
Date Started	9/21/06	Pipe Size	O.D. 2 in.	Boring Method	3-1/4 HSA	Date Completed	9/21/06

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

SAMPLE TYPE
DS - DRIVEN SPLIT SPOON
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

GROUNDWATER DEPTH
FIRST NOTED None ft.
AT COMPLETION Dry ft.
AFTER -- hr -- ft.
BACKFILLED Immed. hrs.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

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Offices
Erlanger, Kentucky
Lexington, Kentucky
Cincinnati, Ohio
Dayton, Ohio

SOIL CLASSIFICATION SHEET

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Properties

Descriptive Term	Percent
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 – 50

Particle Size Identification

Boulders	- 8 inch diameter or more	
Cobbles	- 3 to 8 inch diameter	
Gravel	- Coarse	- 3/4 to 3 inches
	- Fine	- 3/16 to 3/4 inches
Sand	- Coarse	- 2mm to 5mm (dia. of pencil lead)
	- Medium	- 0.45mm to 2mm (dia. of broom straw)
	- Fine	- 0.075mm to 0.45mm (dia. of human hair)
Silt		- 0.005mm to 0.075mm (Cannot see particles)

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Field Identification	Unconfined Compressive Strength (tons/sq. ft.)
Very Soft	Easily penetrated several inches by fist	Less than 0.25
Soft	Easily penetrated several inches by thumb	0.25 – 0.5
Medium Stiff	Can be penetrated several inches by thumb with moderate effort	0.5 – 1.0
Stiff	Readily indented by thumb but penetrated only with great effort	1.0 – 2.0
Very Stiff	Readily indented by thumbnail	2.0 – 4.0
Hard	Indented with difficulty by thumbnail	Over 4.0

Classification on logs are made by visual inspection.

Standard Penetration Test – Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log (Example – 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.). Refusal is defined as greater than 50 blows for 6 inches or less penetration.

Strata Changes – In the column "Soil Descriptions" on the drill log, the horizontal lines represent strata changes. A solid line (————) represents an actually observed change; a dashed line (— — — —) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

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ROCK CLASSIFICATION SHEET

ROCK WEATHERING

Descriptions	Field Identification
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than it its fresh condition.
Highly Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Residual Soil	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact with bedding planes visible, and the soil has not been significantly transported.

ROCK STRENGTH

Descriptions	Field Identification	Uniaxial Compressive Strength (psi)
Extremely Weak	Indented by thumbnail	40-150
Very Weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	150-700
Weak	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	700-4,000
Medium Strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of a geological hammer.	4,000-7,000
Strong	Specimen requires more than one blow of a geological hammer to fracture.	7,000-15,000
Very Strong	Specimen requires many blows with a geological hammer to fracture.	15,000-36,000
Extremely Strong	Specimen can only be chipped with geological hammer.	>36,000

BEDDING

Descriptive Term	Bed Thickness
Massive	> 4 ft.
Thick	2 to 4 ft.
Medium	2 in. to 2 ft.
Thin	< 2 in.

BASE MAP TAKEN FROM THE UPDATED VERSION OF SHEET C-02-312, DATED JUNE 2010, PROVIDED TO US ON AUGUST 30, 2010.

Drawing Revisions	
Date:	Description:
9/8/2010	Updated site plan, grading, and added historical borings

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Title: REVISED BORING PLAN

Client: Malcolm Pirnie, Inc.

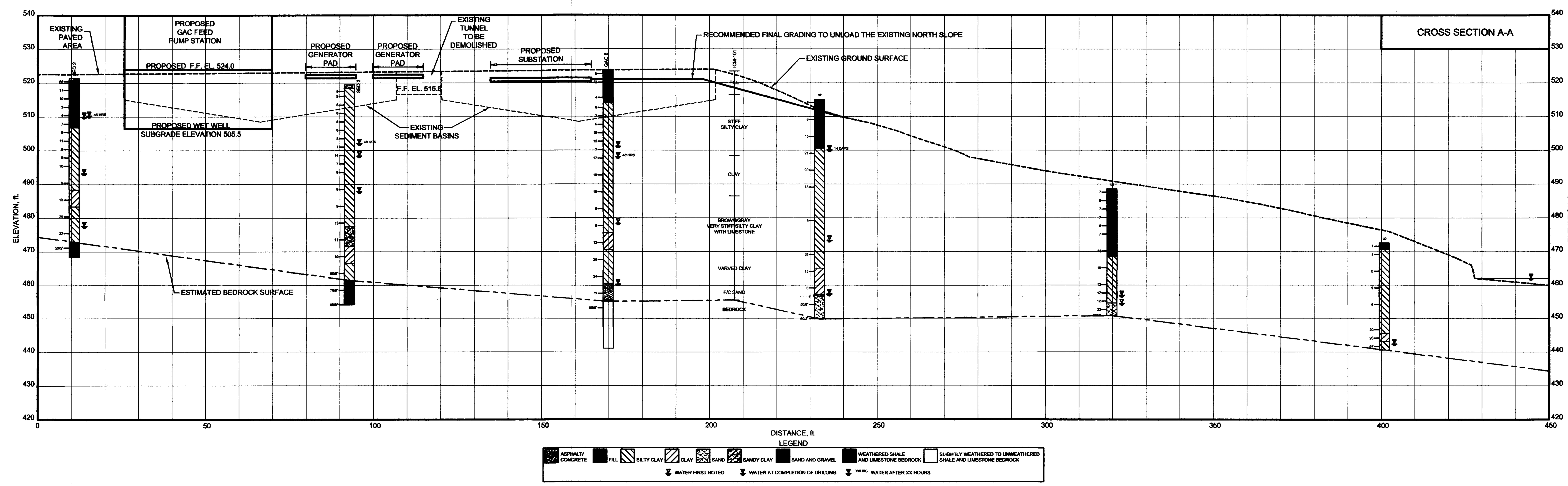
Project: Geotechnical Exploration
Advanced Treatment Upgrades
Taylor Mill Treatment Plant

Location: Taylor Mill, Kentucky

Scale: 1" = 30'

Date: 9/8/2010

Drawing No.: 081069E-100



Drawing Revisions	
Date:	Description:

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Title: CROSS SECTION A-A

Client: Malcolm Pirnie, Inc.

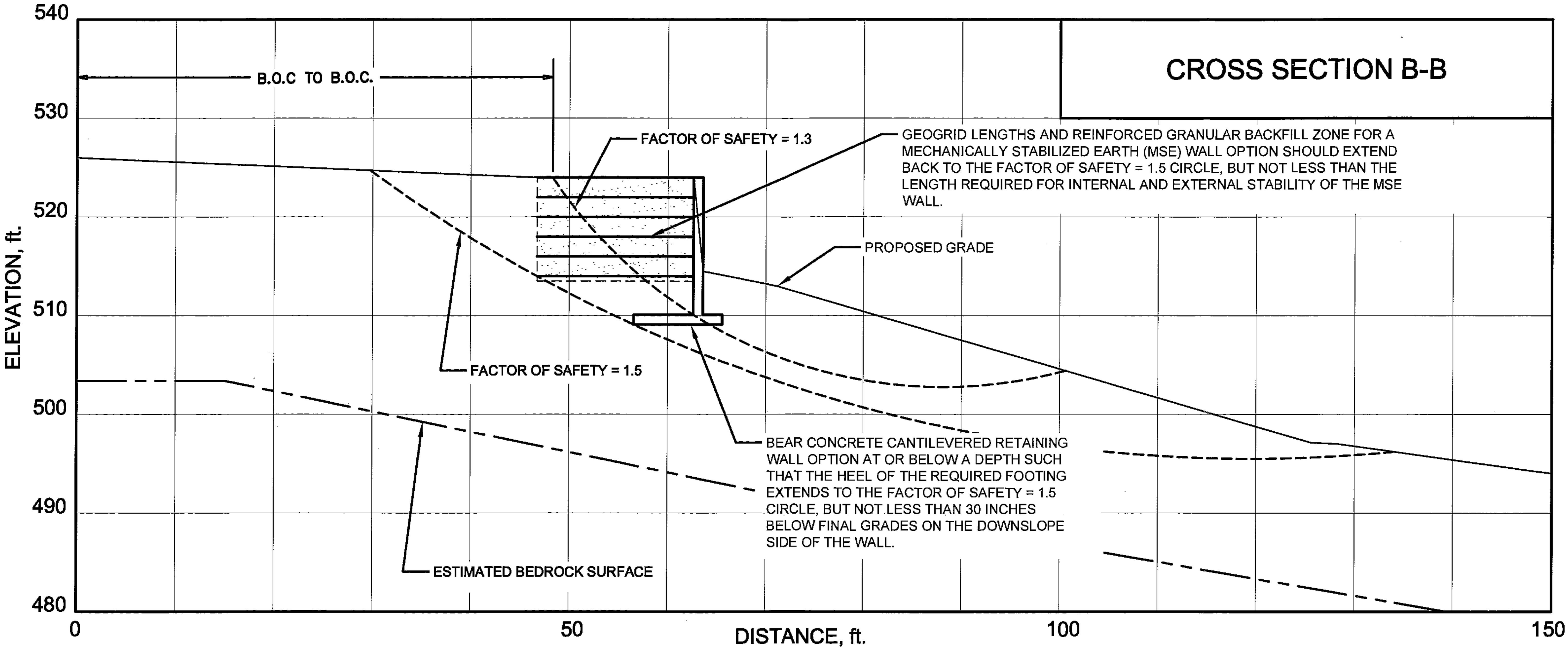
Project: Geotechnical Exploration
Advanced Treatment Upgrades
Taylor Mill Treatment Plant

Location: Taylor Mill, Kentucky

Scale: 1" = 20'

Date: 9/8/2010

Drawing No.: 081069E-200



Notes

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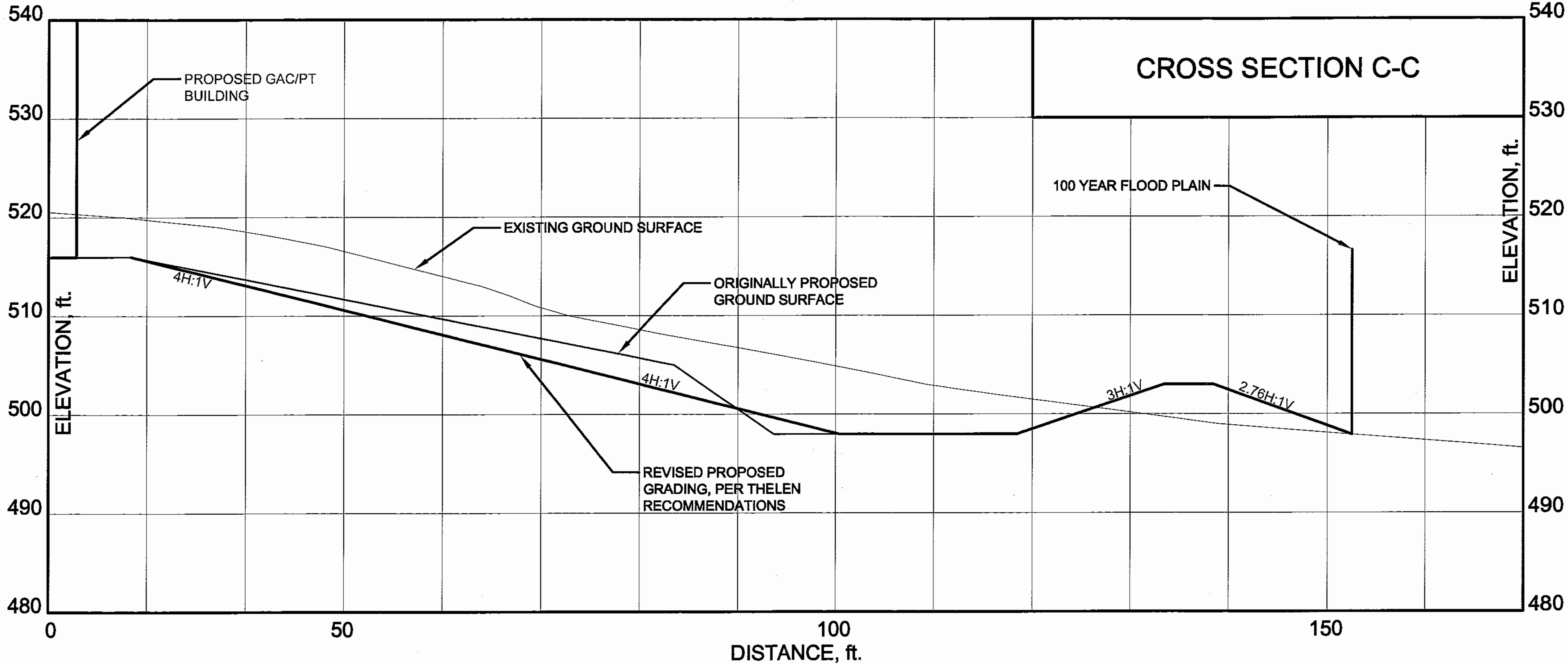
Title: Proposed Retaining Wall 'A'

Client: Malcolm Pirnie, Inc.

Project: Geotechnical Exploration
Advanced Treatment Upgrades
Taylor Mill Treatment Plant

Location: Grand Avenue
Taylor Mill, Kentucky

Scale: 1"=10'
Date: 9/8/10
Drawing No.: 081069E-300



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Title: Proposed Detention Basin

Client: Malcolm Pirnie, Inc.

Project: Geotechnical Exploration
Advanced Treatment Upgrades
Taylor Mill Treatment Plant

Location: Grand Avenue
Taylor Mill, Kentucky

Scale: 1"=10'

Date: 9/8/10

Drawing No.: 081069E-400