

# OPERATIONS AND MAINTENANCE (O&M) PLAN

REVISION 0

Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia

**Prepared Under:**

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**Prepared For:**

**U.S. Environmental Protection Agency Region 4**

Superfund Division

Atlanta, Georgia



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## Acronyms and Abbreviations

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
Black & Veatch	Black & Veatch Special Projects Corp.
bgs	below ground surface
cy	cubic yard
DoT	Department of Transportation
EPA	U.S. Environmental Protection Agency
EPD	Environmental Protection Division
GA	Georgia
IC	institutional control
LLDPE	Linear Low Density Polyethylene
O&M	Operations and Maintenance
Owner	City of Camilla
pH	hydrogen ion concentration
RA	Remedial Action
Site	Camilla Wood Preserving Site

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## 1.0 Introduction

An essential component of a comprehensive stormwater management program is the ongoing operation and maintenance (O&M) of the various components of the stormwater drainage, control, and conveyance systems. Ideally, a local program should address O&M concerns proactively instead of reacting to problems. O&M activities can include cleaning and maintenance of catch basins, drainage swales, conveyance ditches, storm sewer pipes, storm water ponds, and other structural controls.

### 1.1 INTENT OF DOCUMENT

Black & Veatch Special Projects Corporation, (Black & Veatch) has prepared this Post-Construction O&M Manual for the Camilla Wood Preserving Site (Site) for the U.S. Environmental Protection Agency (EPA) and the City of Camilla (owner). This manual is a supplement to the Remedial Action (RA) report documents submitted to the EPA under separate cover. Construction activities relating to the storm water pond began during Fiscal Year 2012 and were completed in early Fiscal year 2013. Repairs to the storm water detention pond were completed in late Fiscal Year 2014.

This manual is intended for use by EPA and the owner for the physical maintenance of the storm water detention pond and ditches located at the Site General components of the remedy addressed in this O&M Manual include the following:

- An engineered storm water detention pond lined with a Linear Low Density Polyethylene (LLDPE) liner.
- Open LLDPE lined storm water inlet conveyance ditch.
- Open unlined storm water inlet conveyance ditch.
- New storm water inlet structures, piping, and flap valve.
- New detention pond discharge structures, piping and gate valve.

This section briefly summarizes the background information for the Site located in the community of Camilla, Mitchell County, Georgia (GA). This section also describes general post-construction care requirements in accordance with the GA Environmental Protection Division (GAEPD) to identify when and how the post-construction care period begins and ends.

### 1.2 SITE LOCATION

The 40-acre Site is located about 0.25 miles west of U.S. Highway 19 in the city of Camilla, Mitchell County, GA. The former wood treating facility is bordered by South Harney Street to the west, Thomas Street to the east, and East Bennett Street to the north. Residential neighborhoods are located just north of the Site and approximately 0.25 mile to the west of the Site. A GA Department of Transportation (DoT) facility borders the Site to the southeast. The western portion of the Site, comprising approximately 23 acres, was remediated by EPA in 2006 and currently serves as an athletic complex, including soccer fields and administrative offices for Mitchell County Parks and Recreation and is the location of the storm water detention pond and conveyance ditches.

### 1.3 ENVIRONMENTAL HEALTH AND SAFETY

In accordance with GAEPD regulations, after construction, the owner will comply with post-construction requirements, including maintenance and monitoring throughout the post-construction care period. No

one shall dig into, excavate, or otherwise disturb the pond and storm water ditch LLDPE liners without first notifying EPA and GAEPD. At a minimum, the following personal protective equipment should be worn during O&M inspections:

- Safety glasses with side shields meeting the requirements and specifications of the current American National Standards Institute (ANSI) Z87 standard.
- Safety-toed boots meeting the requirements and specifications for impact and compression resistance, as required by American Society for Testing and Materials (ASTM) F2412/F2413 (formerly ANSI Z41, Class 75, for footwear purchased prior to March 2005).

## **1.4 ORGANIZATION OF THIS MANUAL**

This manual discusses site-specific needs to operate, provide appropriate upkeep, and maintenance of the installed RA construction items including the facilities, equipment, and appropriate engineered and institutional controls (ICs) pertaining to post-construction at this Site. The text references GAEPD requirements as applicable.

The format of this manual provides an easy reference to specific O&M topics. Section 2 presents an overview of the design and functional description of key components of the storm water detention pond and inlet conveyance ditches, Section 3 describes the post-construction care, and Section 4 addresses site monitoring, inspection, and maintenance procedures.

Appendices are included at the end of this manual to provide supporting documentation. Appendix A contains the relevant figures and As-Built surveys from the site RA Report. Appendix B provides copies of manufacturer's catalog data detailing specific liners/equipment installed at the Camilla Wood Preserving Site as part of the construction project.

## 2.0 Design and Function of the Remediation Components

### 2.1 INTRODUCTION

This section presents an overview of the design and functional description of the following key elements of the Camilla Wood Preserving Site RA, specifically the construction of a lined storm water detention pond and site drainage improvements.

Drawings showing post-construction conditions and details of the above facility are included in Appendix A.

### 2.2 SCOPE OF WORK

The scope of work for this manual is post-construction inspection and O&M of the storm water detention pond and conveyance ditches. The specific tasks associated with this work includes construction of a 7-acre lined storm water detention pond and associated drainage pipes and ditches to alleviate onsite and reduce offsite flooding issues.

Major tasks associated with the completion of the storm water detention pond and ditches include the following:

- Site clearing and grubbing
- Excavation of 7-acre area to a depth of four feet below ground surface (bgs)
- Construction of berms using 25,000 cubic yards (cy) of clean onsite fill
- Grading of existing onsite conveyance ditches to improve flow
- Backfilling the conveyance ditches to the south and east of the pond and grading to direct surficial flows into new drop inlets
- Installation of detention pond inlet structure, piping and flap valve
- Installation of detention pond outlet structures, piping and gate valve
- Surveying the detention pond excavation and inlet channels
- Backfilling, potential tree replanting, and site restoration on the 3 off-site parcels
- Lining of the newly constructed detention pond and the City of Camilla open storm water release conveyance ditch with 36 mil LLDPE liner
- Installation of new permanent fencing to secure the Site

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## 3.0 Post-Construction Care

In accordance with the GAEPD regulations, post-construction care will begin immediately upon completion of the storm water detention pond and site drainage facilities and the authorization of a Closure Certificate, and then continue for a period of at least 30 years. Post-construction care will be conducted in accordance with EPA and GAEPD regulations by the Owner.

### 3.1 POST-CONSTRUCTION CARE REQUIREMENTS

The Owner will comply with post-construction requirements, including maintenance and monitoring throughout the post-construction care period. The Owner will:

- Maintain the integrity of the liner/berms, including making repairs, as necessary, to correct penetrations, subsidence, erosion, or other events.
- Maintain the condition of storm water features and appurtenances, ensuring that conveyance ditches are clear and blockages are removed.
- Ensure that the following institutional controls are enforced.
  - Restrictive covenant to limit future land use to nonresidential uses only;
  - Prohibit potable groundwater use on the property;
  - Prohibit soil removal or excavation that penetrates the liner system within the boundary of the capped area; and

Other considerations that should be taken into account include:

- Adequate access must be provided for inspection, maintenance, and landscaping upkeep, including appropriate equipment and vehicles.
- It is highly recommended that the storm water detention pond and conveyance ditches be inspected annually during winter freeze periods to look for signs of improper operation.
- It is highly recommended that sediment removal in the storm water detention pond and conveyance ditches occur every 2 to 7 years or after 50 percent of total detention pond or conveyance ditches capacity has been lost. Sediment removal should be accomplished by utilizing hand tools only, no heavy machinery. Hand tools should be plastic, fiberglass, or other non-metal material to prevent accidental cutting of the liner.
- Sediments excavated from storm water detention pond and/or conveyance ditches can be safely disposed by either land application or land filling. Periodic mowing of the storm water detention pond and conveyance ditches' buffer area is highly recommended. This includes all areas surrounding the detention pond and conveyance ditches. Care must be taken when trimming along the liner key trench so as not to cut the liner material.
- Care should be exercised while draining the detention pond to prevent rapid release and minimize the discharge of sediments.
- Regular inspections must be made to ensure there are no burrowing animals present along the berms of the detention pond or conveyance ditches in order to prevent compromise of the liner system.

- Regular inspections must be made to ensure there are no roots penetrating the detention pond or conveyance ditch berms in order to prevent compromise of the liner systems. This may require periodic spot removal of sediments in order to prevent vegetation from taking root.
- Regular inspections of the fence system should be made to ensure minimizing trespass by people and animals.
- Additionally, routine inspections should be made to identify damage to the liner systems and if necessary to schedule a qualified LLDPE liner installation company to make any necessary repairs.

### **3.2 CERTIFICATION OF THE COMPLETION OF THE POST-CONSTRUCTION CARE PERIOD**

Post-construction care documentation is important for the termination of the post-construction care period. Post-construction certification will be required in the future to verify that the proposed care activities were conducted in accordance with the EPA-approved plan. An independent engineer is not expected to verify that every activity was conducted over the 30-year post-construction care period for certification purposes; however, a visual inspection of site conditions and a review of all internal documentation will be conducted to evaluate whether the post-construction care activities were performed adequately.

Therefore, at a minimum, the owner will be required to maintain copies of all inspection reports prepared by the EPA or other independent parties, City conducted field reports documenting inspections and completed maintenance, so that appropriate documentation will be available to certify that post-construction care has been completed.

## 4.0 Site Monitoring, Inspection, and Maintenance

This section addresses post-construction monitoring, inspection, and maintenance procedures for the Site. Post-construction care, as addressed in this manual, includes considerations for monitoring of erosion and sedimentation, storm water facilities maintenance, inspections, mowing, and other types of maintenance after construction completion. This post-construction manual specifies reasonable monitoring and maintenance activities for the Site facilities. Since it is difficult to predict, with certainty, the activities required over the entire operation period, this plan proposes a range of alternatives to minimize future O&M plan modifications.

### 4.1 MONITORING, INSPECTION AND MAINTENANCE REQUIREMENTS

After construction, the owner will comply with post-construction care requirements, including inspection, maintenance, and monitoring. Throughout the post-construction period, the owner will continue to monitor the effectiveness of the remedial measures throughout the life of the remedy. Monitoring, inspection, and maintenance requirements for the post-construction period include:

- Maintaining the integrity of the storm water detention pond system, including making necessary repairs to the liner and soil cover components, to correct the effects of erosion or other events.
- Preventing run-on and runoff from eroding or otherwise damaging the constructed berms.
- Ensuring the engineering and institutional controls are being enforced.

#### 4.1.1 Inspections

Inspections should be performed on a regular basis (e.g. monthly or quarterly) and scheduled based on the stormwater control type and characteristics. In addition, inspections should occur after (and even during) major rainfall events of those components most critical to the effective facility operation (inlet structures and channels, outlet structure, pond perimeter).

Not all inspections can be conducted by direct human observation. For subsurface piping systems video equipment may be required. The inspection process should document observations made in the field. Comments should be archived on structural conditions, hydraulic operational conditions, evidence of vandalism, condition of vegetation, occurrence of obstructions, unsafe conditions, and build-up of trash, sediments and pollutants.

#### 4.1.2 Maintenance Scheduling and Performance

Maintenance activities can be divided into two types: scheduled and corrective. Scheduled maintenance tasks are those that are typically accomplished on a regular basis such as monthly or quarterly. These items consist of such things as vegetation maintenance (such as grass mowing) and trash and debris removal from ditches and the pond. These tasks are required at well-defined time intervals.

Corrective tasks consist of items such as sediment removal, bank stabilization, and outlet structure repairs that are done on an as-needed basis. These tasks are typically scheduled based on inspection results. Corrective maintenance sometimes calls for more specialized expertise and equipment than for scheduled tasks.

## 4.2 INSPECTION ITEMS, FREQUENCY, AND ROUTINE MAINTENANCE

Inspections and maintenance will be conducted as specified in this O&M Manual. Small problems that can easily worsen to more significant problems should be addressed and repaired in a timely manner. The following items will require periodic inspection and maintenance:

- Storm water detention pond and inlet channel liners.
- Storm water structures and appurtenances.
- Site security facilities.
- Vegetative cover.

Table 4-1 presents a checklist of many of the potential problems typically associated with each of the above listed items and associated schedule of inspection. The inspection schedule is approximate. Note that all inspections may not result in written documentation unless deficiencies are found.

Table 4-2 presents a checklist of several types of maintenance items typically required for each of the above items and a schedule for routine maintenance. The schedule for routine maintenance is approximate and may be revised, based on operator experience, to an as needed basis.

## 4.3 INSPECTION REPORTING

An inspection log with explanations of observations made will document each inspection and become part of the operating records for the RA at the Camilla Wood Preserving Site. Inspection logs will be in a checklist/fill-in-the blank-format. All inspection reports will include the date, time, and location of inspected item, weather conditions, and name of the individual conducting the inspection. An example of a typical inspection log is provided in Table 4-3. The log is formatted to ensure a specific itinerary is followed and that all pertinent item/component identified is inspected. The log also includes a checklist of typical problems associated with each item/component to be inspected. A blank space is provided to record observations and comments/suggested corrective action. The inspection logs will be supplemented, as necessary, with written reports documenting failures/problems and mitigating actions taken.

The inspection logs will be completed for each of the specific areas or equipment listed in the inspection schedule and will be maintained in a permanent binder. Separate written reports documenting maintenance activities and RAs shall be recorded together with these logs. These inspection and maintenance logs are critical in providing a post-construction case history for the Camilla Storm Water Detention Pond project.

Preventive, non-emergency maintenance shall be completed as soon as practical to preclude further damage and minimize the need for emergency corrective action. If a hazard is determined to be imminent or has already occurred during the course of the inspection or any time between inspections, corrective actions shall be implemented immediately with notification to the appropriate authorities. An example of a typical preventive maintenance log is provided in Table 4-2.

A discussion of specific inspection and maintenance objectives for each item addressed in Tables 4-1 through 4-3 is presented in the following paragraphs.

## 4.4 SPECIFIC INSPECTION AND MAINTENANCE OBJECTIVES

### 4.4.1 Storm Water Detention Pond

Inspection of the pond will include a weekly "windshield survey" and a quarterly site walkover with a specific itinerary of observations to be made. Specific ground surface observations to be documented include:

- Exposed/damaged liner
- Vegetation deterioration
- Berm erosion
- Animal burrows/mounds
- Condition of rip rap on pond berms

Locations where deficiencies are observed should be recorded by a field sketch on the half-scale As-Built Drawings (Appendix A) with reference (distance) to easily recoverable site features. Permanent site features may be used for horizontal control in documenting minor suspect areas, however a field survey is recommended to document any areas where significant settlement or deficiencies have been observed.

Routine maintenance of grassed areas may include annual reseeding, as necessary, for those areas of sparse or stressed vegetation. As a minimum, the grass should be mowed down to 4 or 5 inches to promote growth of shallow rooted grass and to kill seedlet trees, shrubs, weeds or other pioneer species. Bare, sparsely covered and drought-damaged areas shall be reseeded no later than early September as the soil moisture content returns to normal levels. Soil testing, including hydrogen ion concentration (pH) measurements, may be performed every 3 years to determine fertilizer and lime requirements, if any. All required soil amendment additions will be completed before September 15 in a given year.

Routine maintenance activities related to the items identified above may include:

- Filling ruts and gullies in eroded berms/ conveyance ditches and re-grading fill and topsoil to match surrounding condition.
- Filling and grading areas of subsidence with fill material and topsoil to match existing surface grading.
- Removal of accumulated vegetation and debris from storm water conveyance ditches and appurtenances.
- Repair or replacement of fencing.
- Replacement of washed out or missing rip rap

Localized subsidence or surface depressions (visual or evidenced by the presence of ponded water following a rain event) will require backfilling and re-grading to reestablish final grading and to ensure proper drainage, as discussed below.

#### 4.4.2 Storm Water Conveyance Ditches and Drainage Structures

The storm water runoff from the upstream area drains to the storm water detention pond. The surface water drainage is anticipated to remain unchanged as the site is developed for future recreational use.

Maintenance of the stormwater system is necessary to assure that local runoff is collected efficiently by the storm water conveyance ditches. The ditches and swales must be inspected at least monthly and after each major storm event. Silt and plant growth should be periodically cleared from all conveyance ditches to remove any obstruction to flow. If erosion occurs on the side slopes or berms, they should be repaired and reconstructed to their original constructed configuration.

The drainage pipes, inlets, flap valve, and headwalls must be inspected at least quarterly and after each major storm event. Maintenance of these storm water structures is very important to the proper functionality of the storm water detention pond. It is possible that over time the drain pipes and inlets will become obstructed by siltation, root growth, and/or debris. Such obstructions must be cleared so that the drainage structures are free flowing.

Fabriform at the upstream end of the lined storm water channel must be inspected for cracking, joint failures, spalling, or undermining. In addition, the drain outfall shall be inspected to verify that it is clear of obstructions and that an appropriate flow of water is being discharged.

#### 4.4.3 Site Security

The integrity of all fencing should be inspected at least monthly during the post-construction monitoring period.

## 5.0 References

Black & Veatch. 2011. Black & Veatch Special Projects Corp., *100% Remedial Design Basis of Design Report for the Camilla Wood Preserving Site*. March 2011

Black & Veatch, 2015. Black & Veatch Special Projects Corp., *Remedial Action Report*. July 31, 2015.

EPA, 2009. U.S. Environmental Protection Agency, *Camilla Wood Preserving Site Record of Decision*. September, 2009.

AMEC. 2001. AMEC Earth and Environmental Center for Watershed Protection. *Georgia Stormwater Management Manual Volume 1 (Stormwater Policy Guidebook)*, August 2001.

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# Tables

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**Table 4-1**  
**Operations and Maintenance Plan**  
**Schedule for Inspections**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Specific Item	Typical Problems	Minimum Suggested Frequency							Notes <sup>1</sup>
		Monthly	Quarterly	Semi-annually	Annually	After Major Storms	Visual	Checklist / Written Report	
Stormwater Pond/Berms	Erosion	■				■	■	■	Written report will be made if problems are observed/encountered.
	Vegetation stress	■				■	■	■	
	Settling/Ponding of Water	■				■	■	■	
	Washouts	■				■	■	■	
	Animal Burrows	■					■	■	
	Scouring	■				■	■	■	
Stormwater Channels/Structures	Erosion		■			■	■	■	Written report will be made if problems are observed/encountered.
	Liner		■			■	■	■	
	Blockages		■			■		■	
	Fabriform	■				■	■	■	
Site Security <sup>2</sup>	Trespassing / Vandalism	■					■	■	Written report will be made if problems are observed/encountered.

**Notes:**

1. Complete inspection log check list on a quarterly basis, unless problems are discovered more frequently. Table is for the first two years. Activities and frequencies are subject to change based on periodic reevaluation of necessary site O&M activities.
2. Security can be enforced more frequently if required. Site security can be performed on an as needed basis.

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**Table 4-2**  
**Operations and Maintenance Plan**  
**Schedule for Preventative (Routine) Maintenance**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Specific Item	Typical Maintenance	Minimum Suggested Frequency									Notes
		As needed <sup>1</sup>	Weekly	Monthly	Quarterly	Semi-annually	Annually	After Major Storms	Visual	File Report <sup>2</sup>	
Stormwater Pond/Berms	Mowing <sup>1</sup>	■							■		Frequency depends on visual observation/as-needed basis. Soil Testing to determine fertilizer and lime requirements may be taken at 3-year intervals, if applicable.
	Reseeding <sup>1</sup>	■					■				
	Fertilizing <sup>1</sup>	■					■				
	Dressing Slopes/ Regrading <sup>1</sup>	■						■	■	■	
	Blockages <sup>1</sup>			■				■	■	■	
Stormwater Channels/Structures	Blockages/Siltation <sup>1</sup>			■				■	■	■	
	Erosion			■				■	■	■	
	Fabriform	■								■	
Site Security	Inspect Fencing			■					■		

**Notes:**

1. Only required based on visual observation. This table is for the first two years, and subject to change based on periodic reevaluation.
2. File report at completion of maintenance activity.

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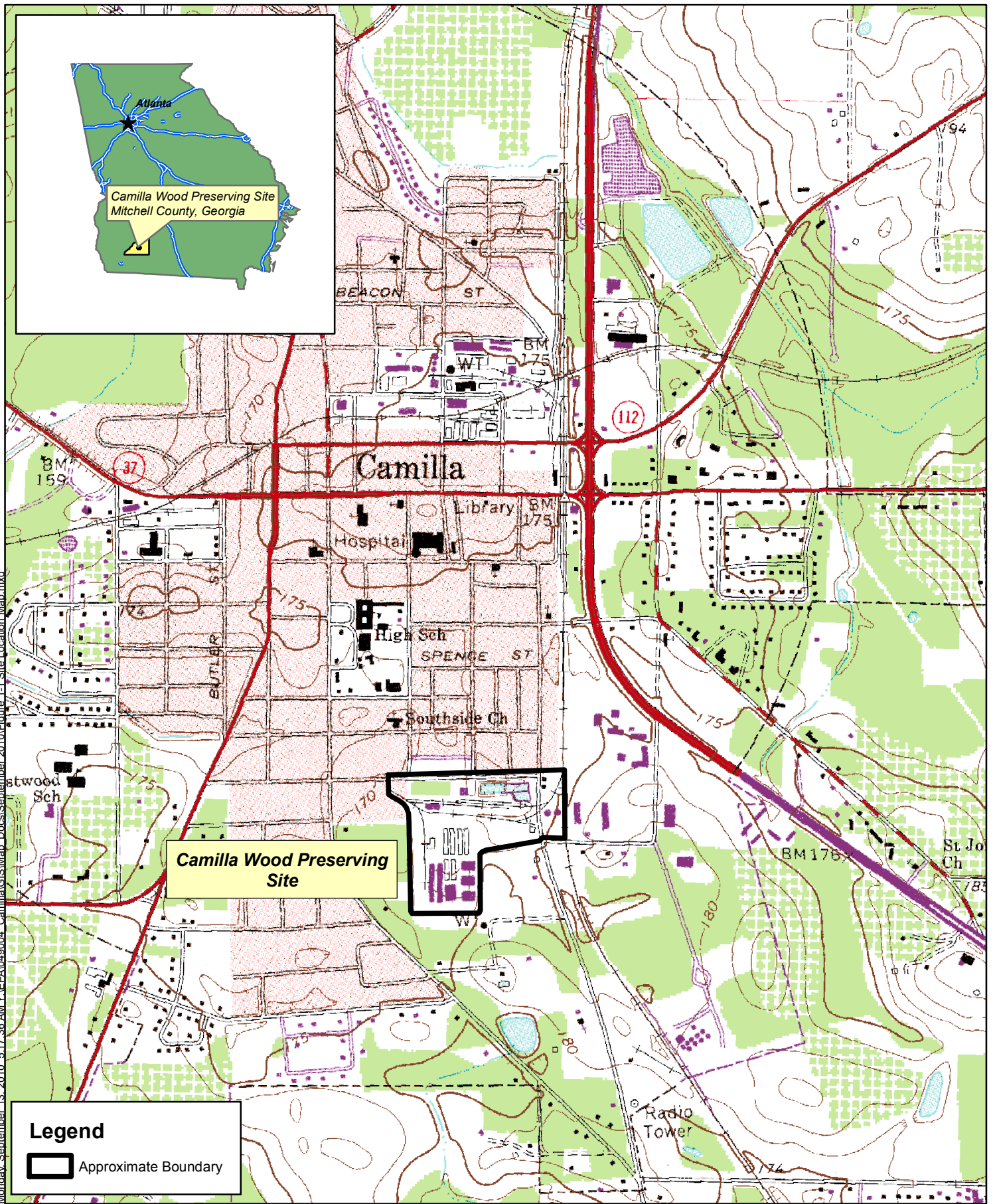
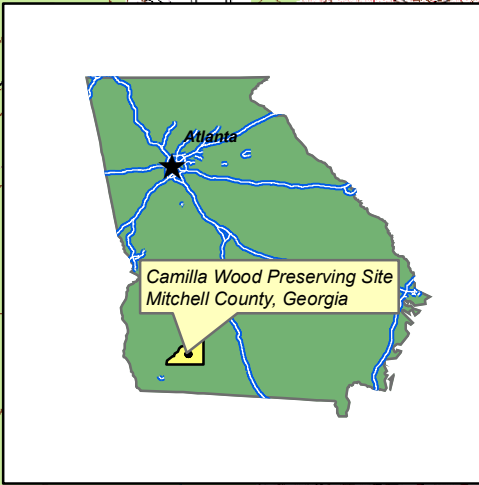
**Table 4-3**  
**Operations and Maintenance Plan**  
**Operations and Maintenance Inspection Report**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Date:		Time:			Sheet: 1 of: 1	
Inspector:						
Weather:				Report No.:		
<b>ITEMS TO INSPECT</b>						
<b>TYPICAL PROBLEMS ENCOUNTERED</b>			<b>CONDITIONS OBSERVED</b>			
			Sat	Unsat	N/A	
<b>AS NEEDED</b>						
Stormwater Pond/Berms	Erosion					
	High Vegetative Growth					
	Sparse Vegetation					
	Vegetation stress					
	Blockages					
	Settling / Ponding of Water					
	Uplift					
	Washouts					
	Mounds					
	Animal Burrows					
	Scouring					
Stormwater Channels/Structures	Erosion					
	Liner					
	Blockages					
<b>MONTHLY</b>						
Stormwater Ponds/Berms	Blockages					
Stormwater Channels/Structures	Erosion					
	Blockages/Siltation					
	Undermining of Fabriform					
Site Security	Trespassing / Vandalism					
<b>AFTER MAJOR STORM</b>						
Stormwater Pond/Berms	Erosion					
	Vegetation stress					
	Settling / Ponding of Water					
	Washouts					
Stormwater Channels/Structures	Scouring					
	Erosion					
	Liner					
	Blockages/Siltation					
Undermining of Fabriform						
Notes:						

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## **Appendix A. Figures and As-Built Surveys from RA Report, Rev 1**

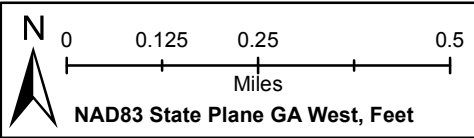
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**Legend**

Approximate Boundary

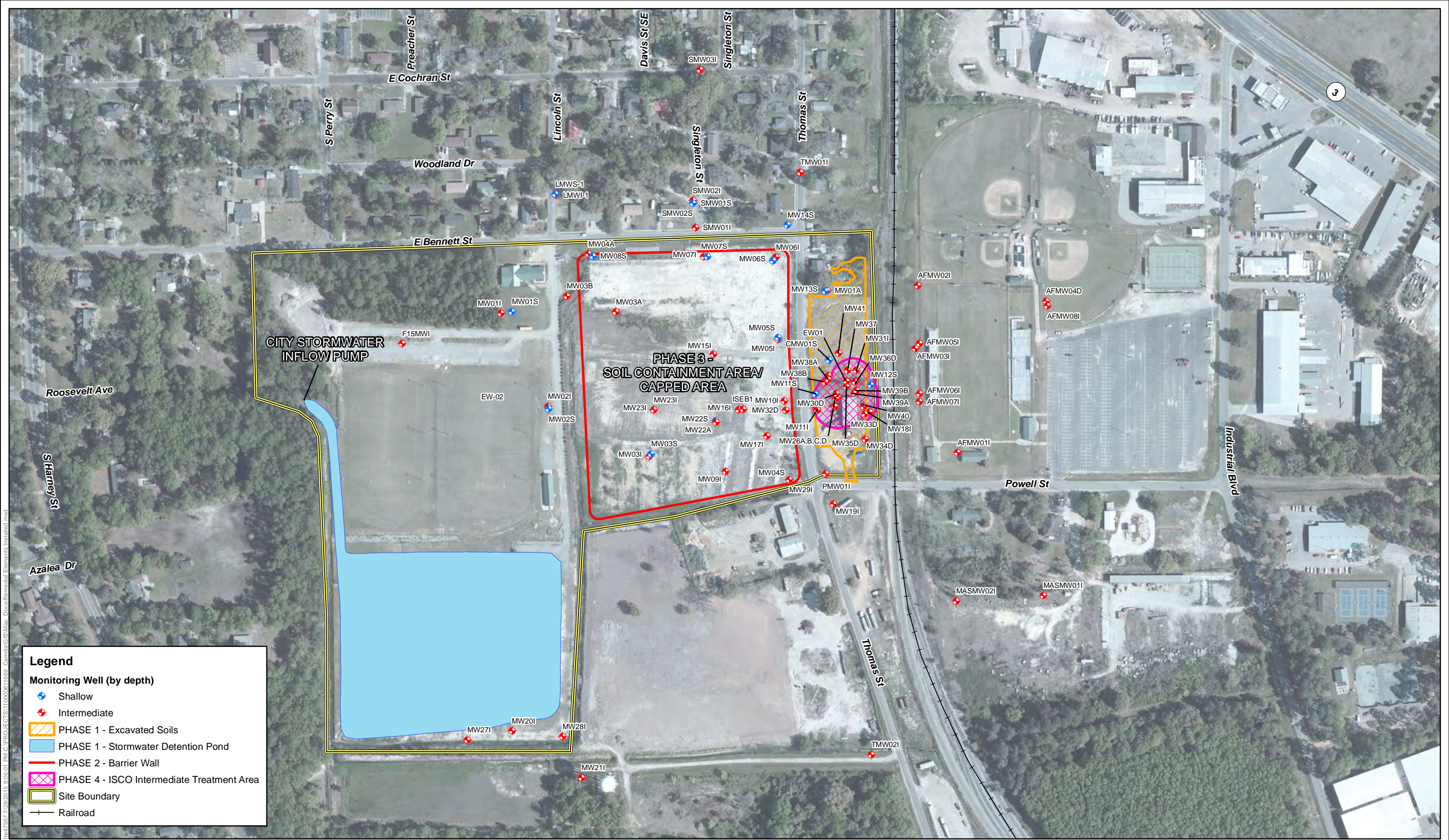
Monday, September 13, 2010 5:17:36 AM Y:\EPA\049004\_Camilla\GIS\Map\_Docs\September 2010\Figure 1-1 Site Location Map.mxd



**Site Location Map**  
**Camilla Wood Preserving Site**  
**Mitchell County, Georgia**

**Figure**  
**1-1**

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**Legend**

**Monitoring Well (by depth)**

- ◆ Shallow
- ◆ Intermediate

- ▨ PHASE 1 - Excavated Soils
- PHASE 1 - Stormwater Detention Pond
- PHASE 2 - Barrier Wall
- ▨ PHASE 4 - ISCO Intermediate Treatment Area
- ▭ Site Boundary
- Railroad

N  
0 250 500  
Feet  
NAD83 State Plane Georgia West, Feet

**Remedial Elements Installed  
Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia**

**Figure  
4-1**

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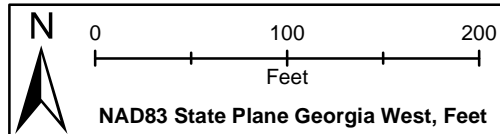
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**Legend**

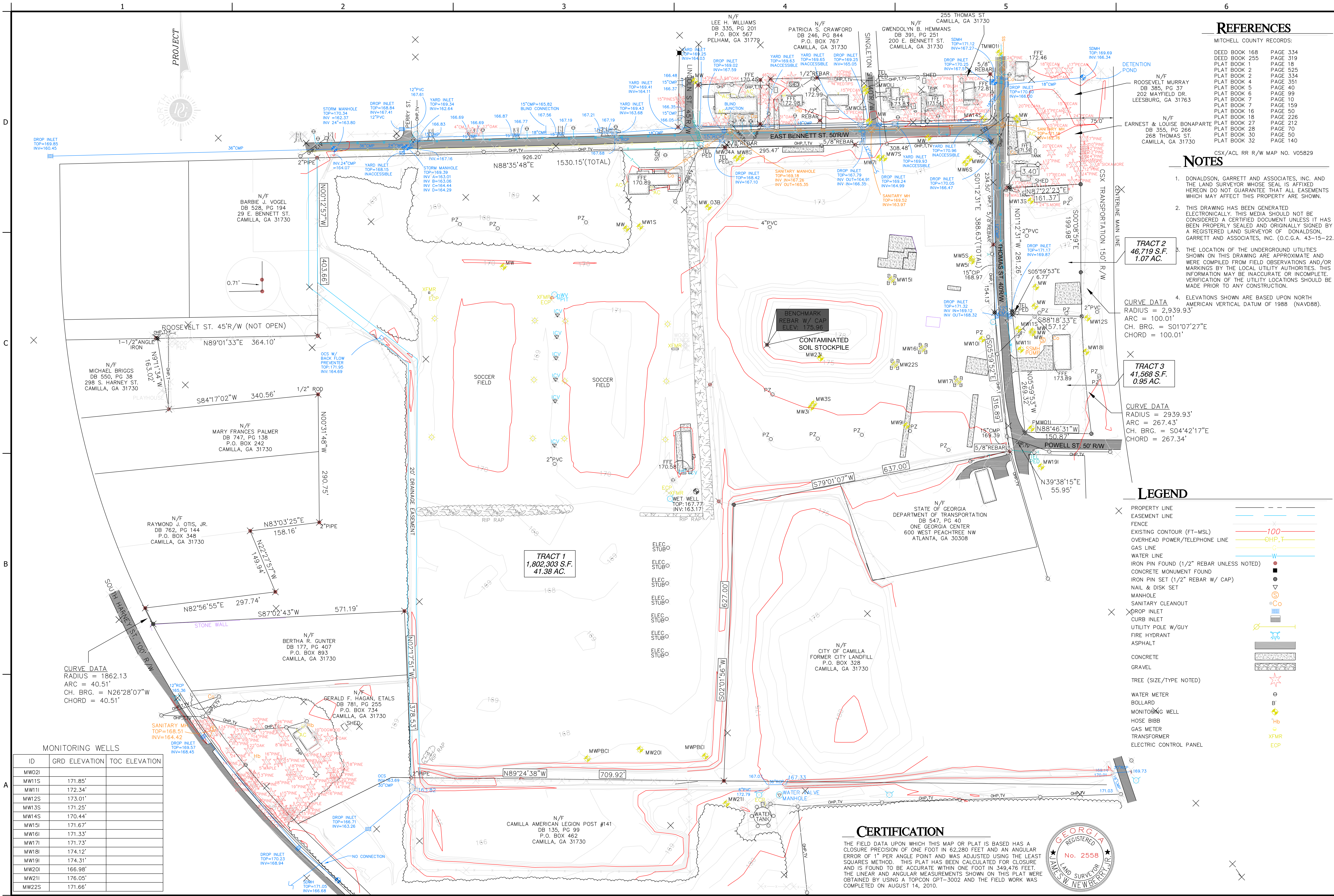
- + Stationing
- BarrierWall
- Railroad
- Site Boundary



**As-Built Barrier Wall Alignment  
Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia**

**Figure  
4-8**

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**REFERENCES**

MITCHELL COUNTY RECORDS:

DEED BOOK 168	PAGE 334
DEED BOOK 255	PAGE 319
PLAT BOOK 1	PAGE 18
PLAT BOOK 2	PAGE 525
PLAT BOOK 2	PAGE 334
PLAT BOOK 4	PAGE 351
PLAT BOOK 5	PAGE 40
PLAT BOOK 6	PAGE 99
PLAT BOOK 7	PAGE 10
PLAT BOOK 16	PAGE 50
PLAT BOOK 18	PAGE 226
PLAT BOOK 27	PAGE 212
PLAT BOOK 28	PAGE 70
PLAT BOOK 30	PAGE 50
PLAT BOOK 32	PAGE 140

**NOTES**

- DONALDSON, GARRETT AND ASSOCIATES, INC. AND THE LAND SURVEYOR WHOSE SEAL IS AFFIXED HEREON DO NOT GUARANTEE THAT ALL EASEMENTS WHICH MAY AFFECT THIS PROPERTY ARE SHOWN.
- THIS DRAWING HAS BEEN GENERATED ELECTRONICALLY. THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT UNLESS IT HAS BEEN PROPERLY SEALED AND ORIGINALLY SIGNED BY A REGISTERED LAND SURVEYOR OF DONALDSON, GARRETT AND ASSOCIATES, INC. (O.C.G.A. 43-15-22.)
- THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THIS DRAWING ARE APPROXIMATE AND WERE COMPILED FROM FIELD OBSERVATIONS AND/OR MARKINGS BY THE LOCAL UTILITY AUTHORITIES. THIS INFORMATION MAY BE INACCURATE OR INCOMPLETE. VERIFICATION OF THE UTILITY LOCATIONS SHOULD BE MADE PRIOR TO ANY CONSTRUCTION.
- ELEVATIONS SHOWN ARE BASED UPON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

**TRACT 2**  
46,719 S.F.  
1.07 AC.

**TRACT 3**  
41,568 S.F.  
0.95 AC.

**CURVE DATA**  
RADIUS = 2,939.93'  
ARC = 100.01'  
CH. BRG. = S01°07'27"E  
CHORD = 100.01'

**CURVE DATA**  
RADIUS = 2939.93'  
ARC = 267.43'  
CH. BRG. = S04°42'17"E  
CHORD = 267.34'

**LEGEND**

- × PROPERTY LINE
- EASEMENT LINE
- FENCE
- EXISTING CONTOUR (FT-MSL)
- OVERHEAD POWER/TELEPHONE LINE
- GAS LINE
- WATER LINE
- IRON PIN FOUND (1/2" REBAR UNLESS NOTED)
- CONCRETE MONUMENT FOUND
- IRON PIN SET (1/2" REBAR W/ CAP)
- NAIL & DISK SET
- MANHOLE
- SANITARY CLEANOUT
- DROP INLET
- CURB INLET
- UTILITY POLE W/GUY
- FIRE HYDRANT
- ASPHALT
- CONCRETE
- GRAVEL
- TREE (SIZE/TYPE NOTED)
- WATER METER
- BOLLARD
- MONITORING WELL
- HOSE BIBB
- GAS METER
- TRANSFORMER
- ELECTRIC CONTROL PANEL

**CERTIFICATION**

THE FIELD DATA UPON WHICH THIS MAP OR PLAT IS BASED HAS A CLOSURE PRECISION OF ONE FOOT IN 62,280 FEET AND AN ANGULAR ERROR OF 1" PER ANGLE POINT AND WAS ADJUSTED USING THE LEAST SQUARES METHOD. THIS PLAT HAS BEEN CALCULATED FOR CLOSURE AND IS FOUND TO BE ACCURATE WITHIN ONE FOOT IN 349,476 FEET. THE LINEAR AND ANGULAR MEASUREMENTS SHOWN ON THIS PLAT WERE OBTAINED BY USING A TOPCON GPT-3002 AND THE FIELD WORK WAS COMPLETED ON AUGUST 14, 2010.



**MONITORING WELLS**

ID	GRD ELEVATION	TOC ELEVATION
MW02I		
MW11S	171.85'	
MW11I	172.34'	
MW12S	173.01'	
MW13S	171.25'	
MW14S	170.44'	
MW15I	171.67'	
MW16I	171.33'	
MW17I	171.73'	
MW18I	174.12'	
MW19I	174.31'	
MW20I	166.98'	
MW21I	176.05'	
MW22S	171.66'	

**BLACK & VEATCH**  
Special Projects Corp.

1120 SANCTUARY PARKWAY SUITE 800  
COLUMBIA, SC 29910  
PHONE: (770) 251-1517 FAX: (770) 761-8822  
WEBSITE: WWW.BV.COM

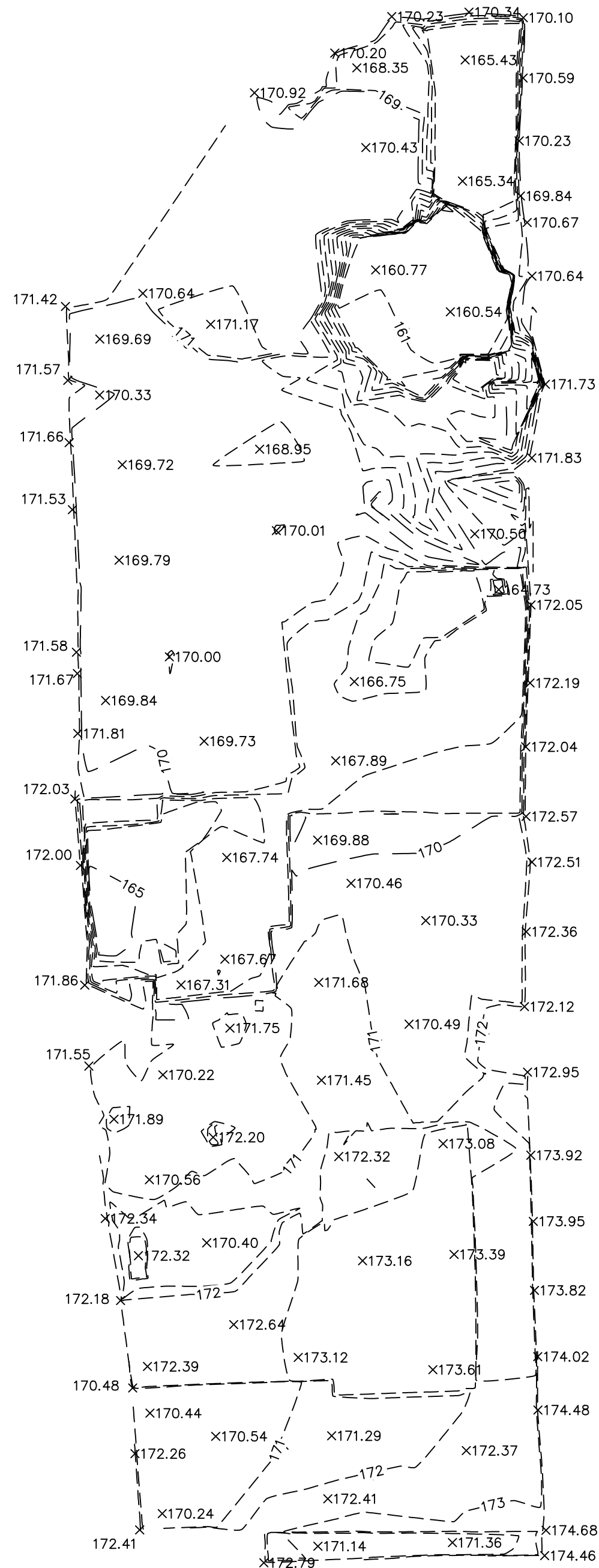
Date	Drawn by	Check by	Project #	Design by	Review by	Scale	Rev.	Description	Date	App.
AUG 2010	JH	JH	49062	JH	JH	1" = 100'				

CAMILLA WOOD PRESERVING SITE  
CAMILLA, MITCHELL COUNTY, GA

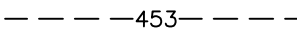
EXISTING SITE SURVEY

DRAWING NO. C-03

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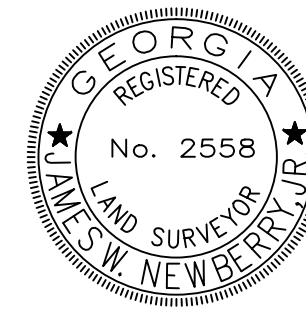
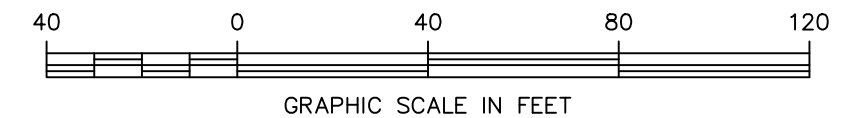
**LEGEND**

CONTOUR LINE  -453-

SPOT ELEVATION  386.29

**NOTES**

1. THIS DRAWING HAS BEEN GENERATED ELECTRONICALLY. THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT UNLESS IT HAS BEEN PROPERLY SEALED AND ORIGINALLY SIGNED BY A REGISTERED LAND SURVEYOR OF DONALDSON, GARRETT AND ASSOCIATES, INC. AUTHORITY OF O.C.G.A. 43-15-22.
2. ONE FOOT CONTOUR INTERVAL SHOWN.
3. ELEVATIONS SHOWN ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM, NAVD 88, BASED ON EXISTING SITE BENCHMARKS ESTABLISHED BY GPS OBSERVATION UTILIZING THE LEICA SMARTNET GEORGIA REFERENCE NETWORK.



EXCAVATION SURVEY

CAMILLA WOOD PRESERVING SITE  
EXCAVATION AREA 2

Prepared For  
GARRETT CONSULTING, INC.

CITY OF CAMILLA      MITCHELL COUNTY      GEORGIA

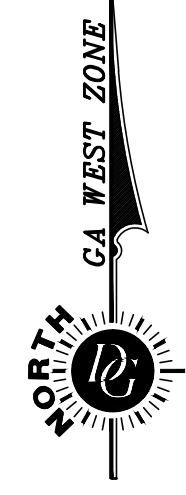
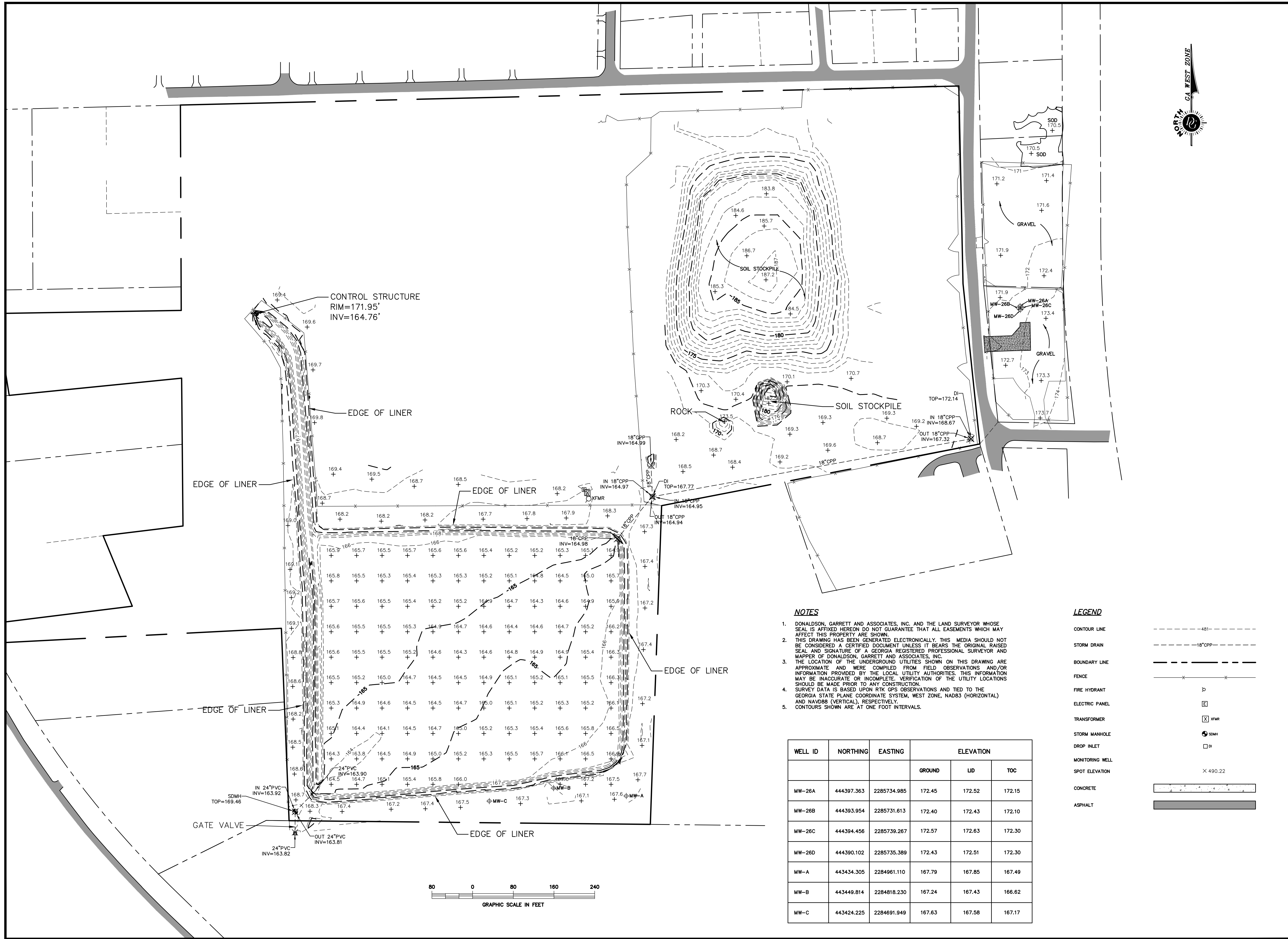
REVISED: 09/18/12 - ADDITIONAL EXCAVATION	R.L.S. NO. 2558
	DATE: JULY 20, 2012
	CHKD: JWN
	DRWN: GREG DAVIS
	PROJ. NO.: 2608-001-D1

SCALE: 1" = 40'
C&G: N/A
DRAWING NO. 4944-12-C
FIELD BOOK: DC


**DG** DONALDSON,  
GARRETT,  
&  
ASSOCIATES, INC.

MACON • CHARLOTTE  
4875 RIVERSIDE DRIVE P.O. BOX 7306  
MACON, GA 31210  
(478)474-5350 Fax: (478) 477-2534  
<http://www.dg-a.com>

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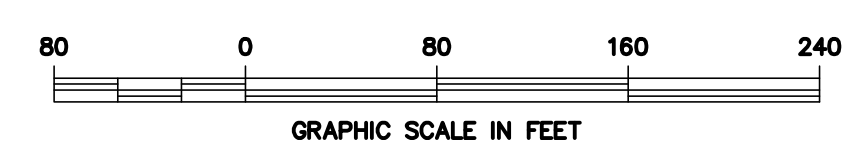
**NOTES**

- DONALDSON, GARRETT AND ASSOCIATES, INC. AND THE LAND SURVEYOR WHOSE SEAL IS AFFIXED HEREON DO NOT GUARANTEE THAT ALL EASEMENTS WHICH MAY AFFECT THIS PROPERTY ARE SHOWN.
- THIS DRAWING HAS BEEN GENERATED ELECTRONICALLY. THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT UNLESS IT BEARS THE ORIGINAL RAISED SEAL AND SIGNATURE OF A GEORGIA REGISTERED PROFESSIONAL SURVEYOR AND MAPPER OF DONALDSON, GARRETT AND ASSOCIATES, INC.
- THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THIS DRAWING ARE APPROXIMATE AND WERE COMPILED FROM FIELD OBSERVATIONS AND/OR INFORMATION PROVIDED BY THE LOCAL UTILITY AUTHORITIES. THIS INFORMATION MAY BE INACCURATE OR INCOMPLETE. VERIFICATION OF THE UTILITY LOCATIONS SHOULD BE MADE PRIOR TO ANY CONSTRUCTION.
- SURVEY DATA IS BASED UPON RTK GPS OBSERVATIONS AND TIED TO THE GEORGIA STATE PLANE COORDINATE SYSTEM, WEST ZONE, NAD83 (HORIZONTAL) AND NAVD83 (VERTICAL), RESPECTIVELY.
- CONTOURS SHOWN ARE AT ONE FOOT INTERVALS.

**LEGEND**

- CONTOUR LINE -481-
- STORM DRAIN -18\"/>

WELL ID	NORTHING	EASTING	ELEVATION		
			GROUND	LID	TOC
MW-26A	444397.363	2285734.985	172.45	172.52	172.15
MW-26B	444393.954	2285731.613	172.40	172.43	172.10
MW-26C	444394.456	2285739.267	172.57	172.63	172.30
MW-26D	444390.102	2285735.389	172.43	172.51	172.30
MW-A	443434.305	2284961.110	167.79	167.85	167.49
MW-B	443449.814	2284818.230	167.24	167.43	166.62
MW-C	443424.225	2284691.949	167.63	167.58	167.17



**DONALDSON GARRETT & ASSOCIATES, INC.**

MACON • CHARLOTTE  
 4875 RIVINGTON DRIVE, BOX 7306  
 MACON, GA 31210  
 (478)474-5350 Fax: (478) 477-2534  
<http://www.dg-a.com>

TOPOGRAPHIC SURVEY  
 FOR  
**GARRETT CONSULTING, INC.**  
 OF  
 CAMILLA WOOD PRESERVING SITE

---

GEORGIA

MITCHELL COUNTY

CAMILLA

DATE: 11/5/2012

DRAWING #: 3173-12-D

PROJ. #: 2608-001-D1

DSGN: DRWN: BS

CHKD: JWN

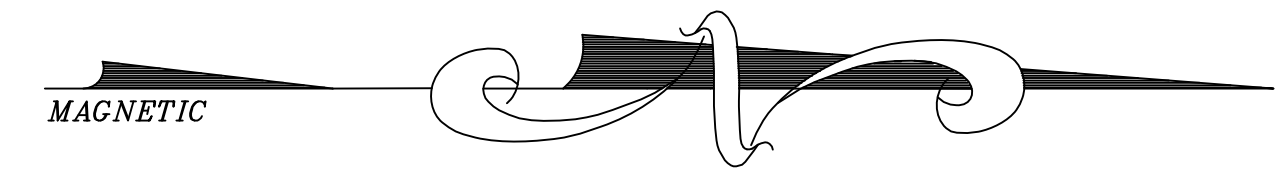
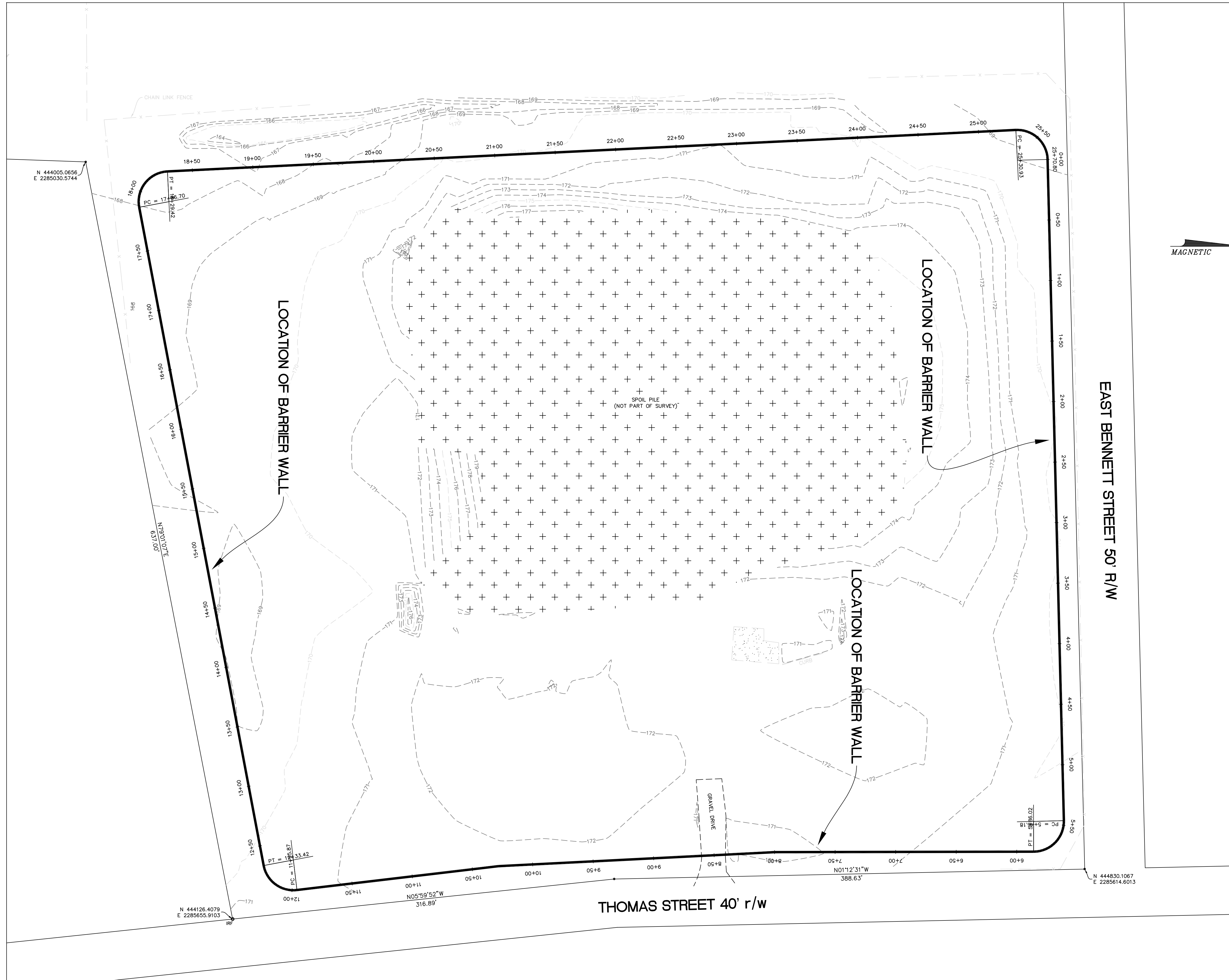
APVD: JWN

RLS No: 2558

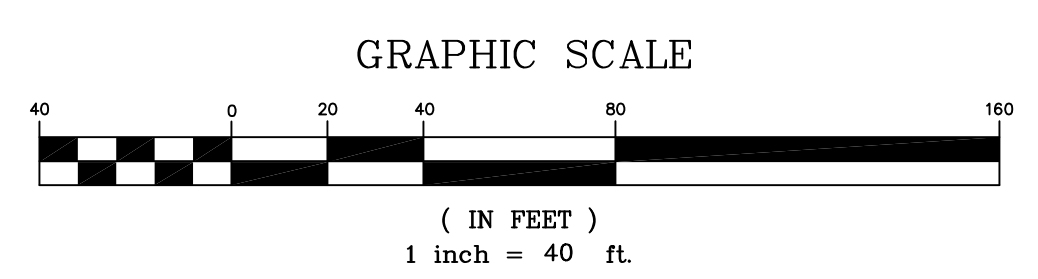
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**SHEET 1 OF 1**

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NOTES:  
 1. PROPERTY LINES TAKEN FROM DRAWING PROVIDED BY BLACK & VEATCH SPECIAL PROJECTS CORP. DATED OCTOBER, 2012.  
 2. LIMITS OF SURVEY AS DEFINED PER JEROME HENDERSON, JR. ON 4/18/13.

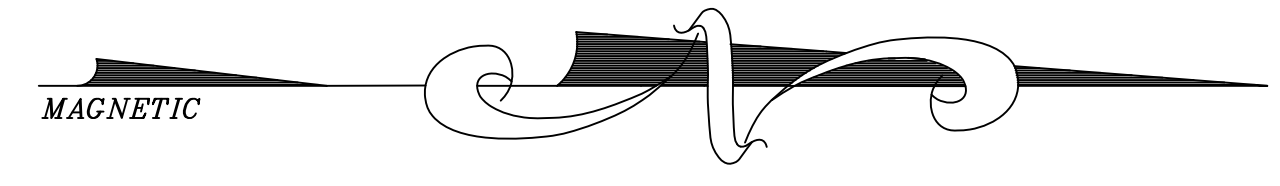
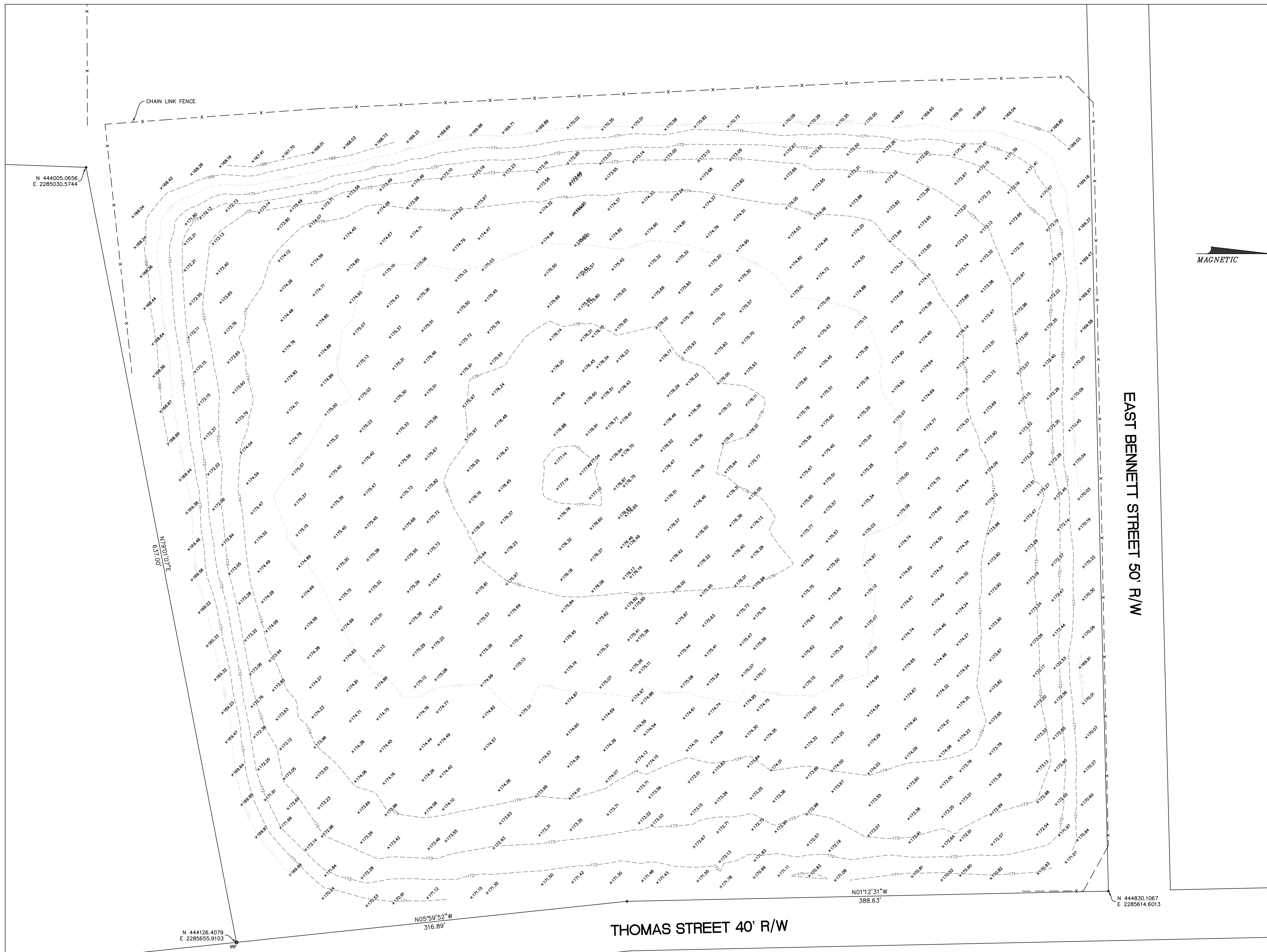


TOPOGRAPHIC SURVEY  
 PREPARED FOR ENTACT  
 CITY OF CAMILLA, MITCHELL COUNTY, GEORGIA

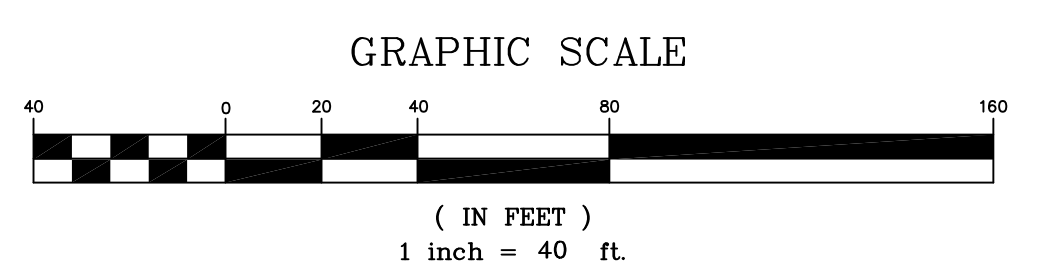


SURVEYED	TH	SCALE	1" = 40'	PROJ. NO.	13019	DATE	04/16/13	SHEET NUMBER	1 OF 1
DRAWN	DCG	CHECKED		DWG	13019FINALTOP	SUR. DATE	04/18/13		

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NOTES:  
1. PROPERTY LINES TAKEN FROM DRAWING PROVIDED BY BLACK & VEATCH SPECIAL PROJECTS CORP. DATED OCTOBER, 2012.



TOPOGRAPHIC SURVEY  
TOP OF CAP AS OF 09/09/13  
CITY OF CAMILLA, MITCHELL COUNTY, GEORGIA

**LANIER**  
ENGINEERING INC.

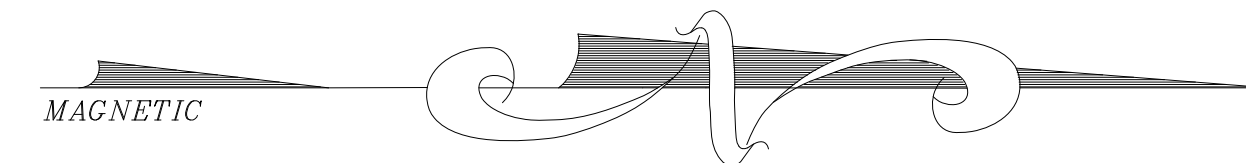
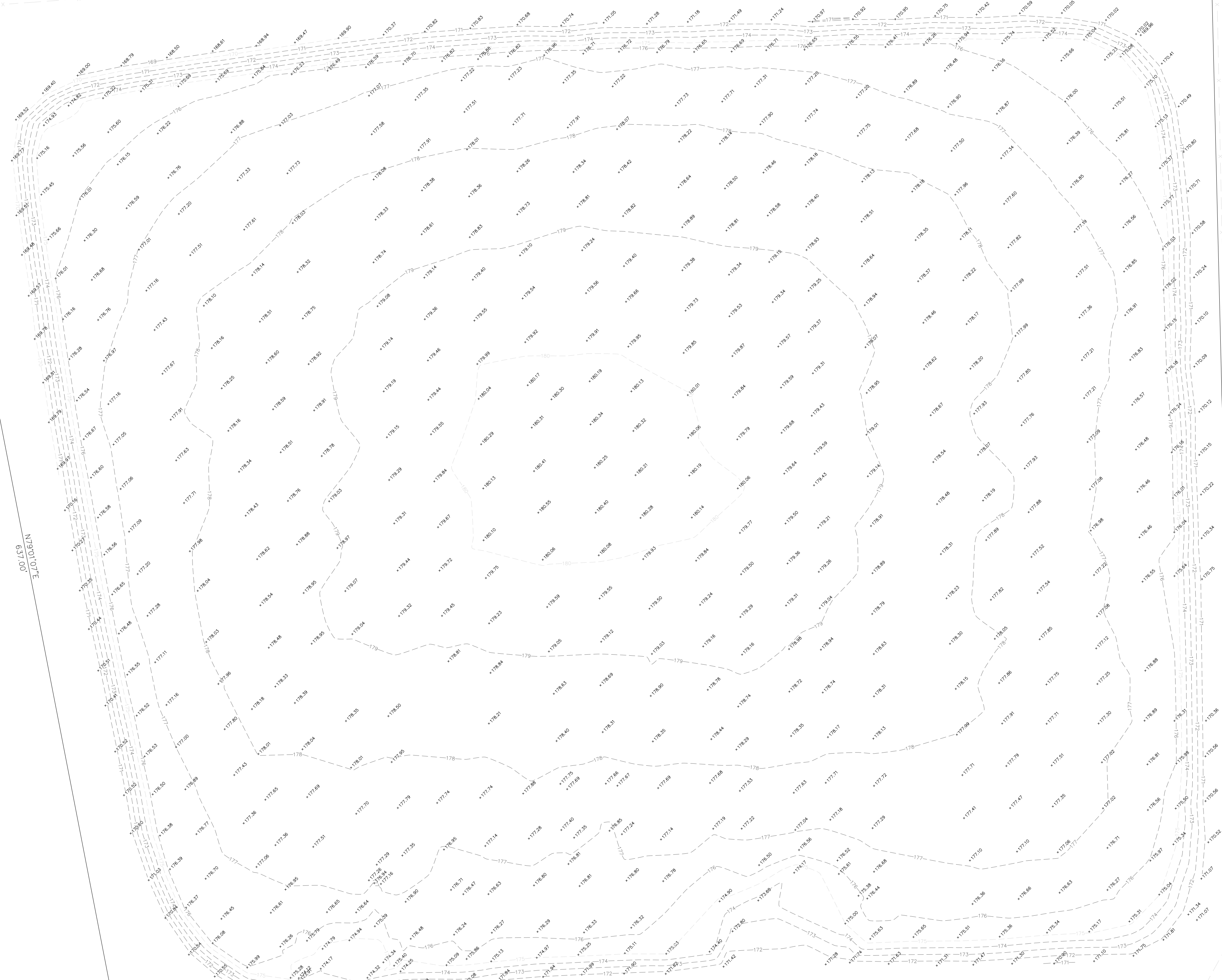
1504 W. THIRD AVENUE ALBANY, GEORGIA 31707  
(229) 438-0522 FAX (229) 438-0921

SURVEYED	TH	SCALE	1" = 40'	PROJ. NO.	13082	DATE	09/10/13	SHEET NUMBER	
DRAWN	DCC	CHECKED		DWG.	UNREVIEWED	SUR. DATE	09/09/13	1	OF 1

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N 444005.0656  
E 2285030.5744

CHAIN LINK FENCE



MAGNETIC

EAST BENNETT STREET 50' R/W

NOTES:

1. PROPERTY LINES TAKEN FROM DRAWING PROVIDED BY BLACK & VEATCH SPECIAL PROJECTS CORP. DATED OCTOBER, 2012.

Site	Surf1	Surf2	Site Volume Table: Unadjusted		Net cu yds	Method
			Cut cu yds	Fill cu yds		
13019 Entact	original site	08-14-13	69	47675	47606 (F)	Grid
	original site	09-09-13	10	56731	56721 (F)	Grid
	original site	11-14-13	0	106025	106025 (F)	Grid
	09-09-13	11-14-13	2	49862	49860 (F)	Grid

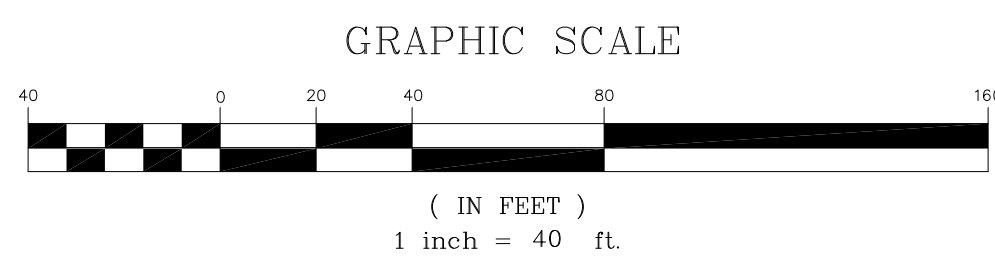
N 444126.4079  
E 2285655.9103

N05°59'52" W  
316.89'

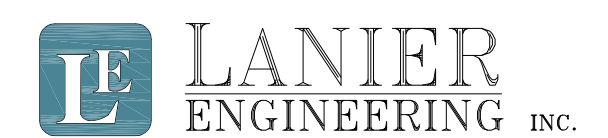
THOMAS STREET 40' R/W

N011°2'31" W  
388.63'

N 444830.1067  
E 2285614.6013



TOPOGRAPHIC SURVEY  
TOPO AS OF 11/14/13  
CITY OF CAMILLA, MITCHELL COUNTY, GEORGIA



LANIER ENGINEERING INC.  
1504 W. THIRD AVENUE ALBANY, GEORGIA 31707  
(229) 438-0522 PAX (229) 438-0921

SURVEYED	TH	SCALE	1" = 40'	PROJ. NO.	13082	DATE	11/16/13	SHEET NUMBER	
DRAWN	DCG	CHECKED		DWG	UNHRAE/EF/AF/AN	SUR. DATE	11/14/13		1 OF 1

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# MAP SHOWING A SPECIFIC PURPOSE SURVEY OF:

A PORTION OF CAMILLA WOOD PRESERVING SITE, MITCHELL COUNTY, GEORGIA

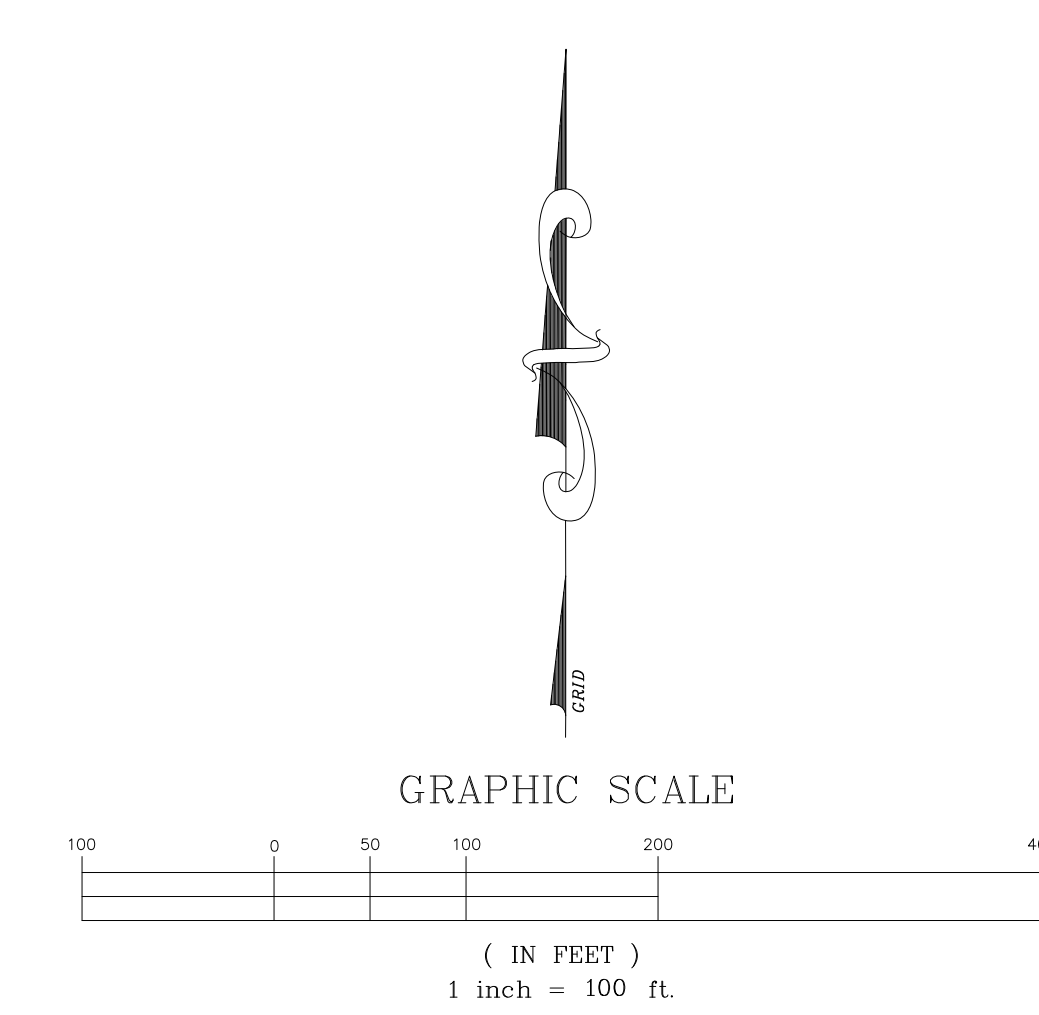
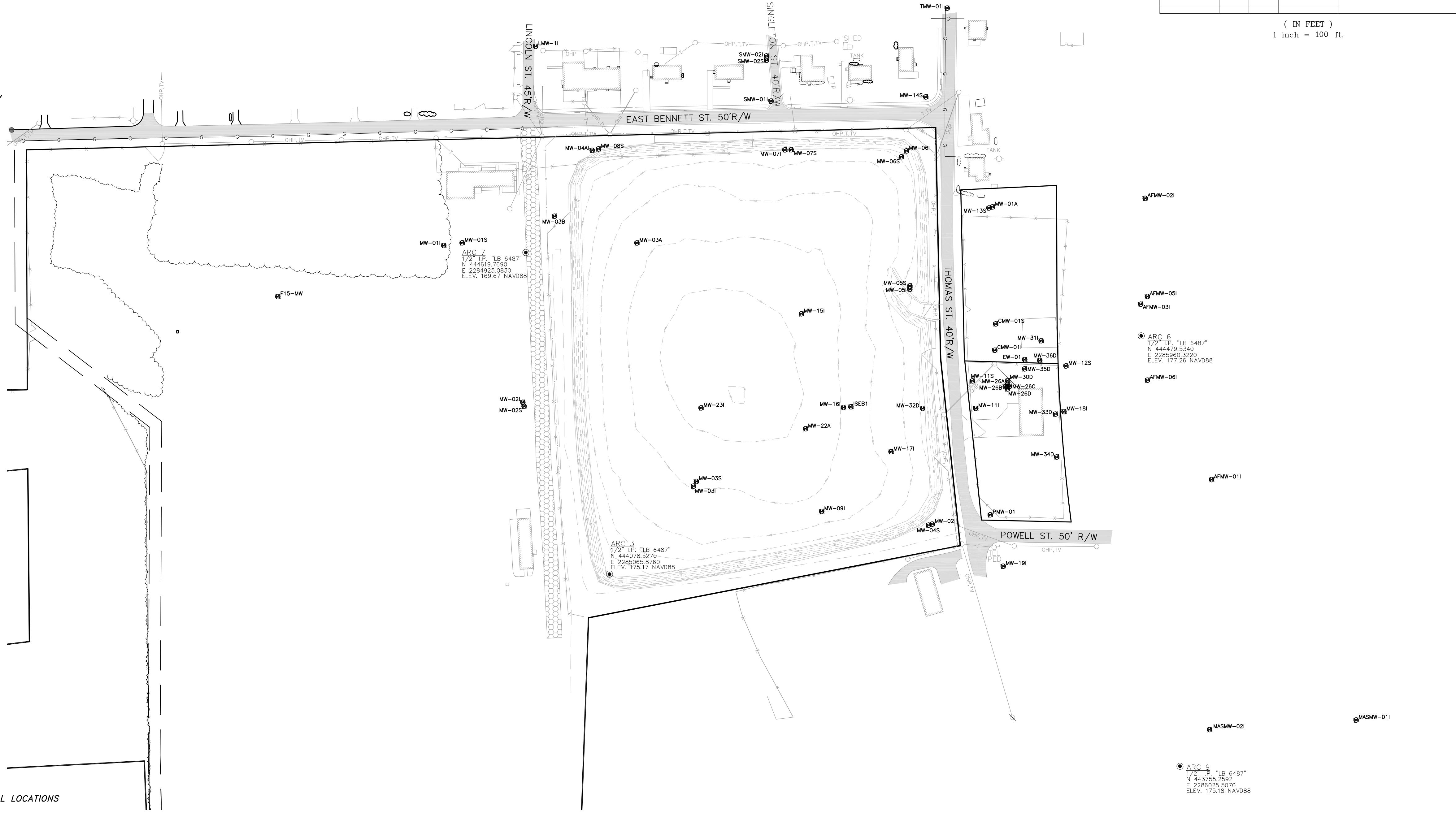


VICINITY MAP  
NOT TO SCALE

## MONITORING WELL TABULATION

DESCRIPTION	NORTHING	EASTING	TOP OF PIPE ELEVATION (NAVD88)	CONCRETE ELEVATION (NAVD88)	GROUND ELEVATION (NAVD88)
AFMW-011	444237.666	2286078.691	179.25	179.54	179.47
AFMW-021	444710.913	2285967.004	175.07	175.60	175.64
AFMW-031	444532.816	2285959.529	176.58	176.78	176.73
AFMW-051	444545.826	2285970.749	177.08	177.39	177.32
AFMW-061	444405.026	2285970.859	178.03	178.40	178.17
CMW-011	444455.375	2285714.001	174.02		172.15
CMW-015	444499.593	2285715.509	174.11		172.15
F15-MW	444545.587	2284507.861	169.59	169.75	169.68
ISEB1	444360.209	2285471.822	178.37	178.70	178.70
LWM-11	444966.786	2284941.675	169.43	169.73	169.77
MASMW-011	443832.983	2286321.809	179.86	180.24	180.19
MASMW-021	443816.875	2286075.348	178.67	178.96	178.79
MW-26D	444390.239	2285735.361	172.31	172.54	172.43
EW-01	444439.501	2285764.345	171.85	172.10	172.08
MW-01A	444696.567	2285710.185	173.15	171.81	171.28
MW-011	444631.566	2284787.053	171.29	168.70	168.80
MW-01S	444636.045	2284817.892	171.38	168.81	168.82
MW-02	444162.715	2285608.833	169.46	169.84	169.92
MW-021	444367.728	2284920.009	169.55	169.74	169.55
MW-02S	444360.999	2284922.149	169.36	169.70	169.61
MW-03A	444635.883	2285111.980	178.30	178.61	178.62
MW-031	444226.605	2285207.028	178.87	179.20	179.16
MW-03S	444234.578	2285211.976	179.01	179.27	179.31
MW-04A1	444791.669	2285036.699	169.56	169.93	169.81
MW-04S	444600.997	2285602.486	169.58	170.01	170.13
MW-051	444557.910	2285571.073	175.07	175.29	175.23
MW-05S	444563.601	2285571.230	175.46	175.69	175.62
MW-061	444780.728	2285565.459	175.29	175.60	175.62
MW-06S	444780.835	2285556.872	175.73	176.07	175.89
MW-071	444792.507	2285360.861	176.05	176.34	176.22
MW-07S	444792.803	2285371.384	176.10	176.37	176.21
MW-08S	444794.061	2285047.342	169.86	170.18	170.02
MW-091	444184.077	2285422.866	178.18	178.52	178.57
MW-111	444357.450	2285682.046	171.91	172.23	172.25
MW-11S	444403.708	2285676.395	171.44	171.73	171.75
MW-12S	444428.892	2285833.703	172.51	172.94	172.89
MW-13S	444594.709	2285704.174	170.56	171.05	171.14
MW-14S	444881.647	2285597.936	169.74	170.37	170.42
MW-151	444516.629	2285388.689	179.41	179.81	179.87
MW-161	444359.002	2285459.478	178.75	179.06	179.20
MW-171	444284.597	2285539.402	177.56	177.82	177.89
MW-181	444352.038	2285830.336	173.48	174.04	173.98
MW-191	444091.878	2285728.168	173.78	174.20	174.21
MW-22A	444323.221	2285595.660	179.79	180.02	180.12
MW-231	444358.268	2285219.817	180.34	180.64	180.68
MW-26A	444397.562	2285734.952	172.17	172.54	172.40
MW-26B	444394.199	2285731.578	172.11	172.43	172.36
MW-26C	444394.567	2285739.027	172.31	172.66	172.55
MW-30D	444404.005	2285735.167	172.17	172.45	172.34
MW-311	444471.287	2285791.932	174.90	172.37	172.23
MW-32D	444357.372	2285592.677	175.60	175.96	175.97
MW-33D	444437.898	2285815.972	173.46	173.75	173.70
MW-34D	444275.671	2285818.142	173.93	174.27	174.23
MW-35D	444423.912	2285764.212	172.24	172.54	172.43
MW-36D	444437.988	2285789.666	171.81	172.22	172.13
MW-3B	444680.868	2284973.359	171.28	169.41	169.32
PMW-011	444178.346	2285705.267	172.58	172.81	172.78
SMW-011	444874.578	2285337.580	169.12	169.61	169.77
SMW-021	444950.538	2285329.877	171.37	171.64	171.51
SMW-02S	444943.381	2285330.020	171.20	171.51	171.37
TMW-011	445031.067	2285633.876	170.72	171.04	

- SURVEY NOTES:**
1. THE SPECIFIC PURPOSE OF THIS SURVEY IS TO SHOW MONITORING WELL LOCATIONS AS REQUESTED BY THE CLIENT.
  2. COORDINATES AND BEARINGS ARE BASED THE STATE PLANE COORDINATE SYSTEM FOR THE STATE OF GEORGIA, WEST ZONE, NAD-83.
  3. ELEVATIONS SHOWN HEREON ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM 88 (NAVD 88).
  4. MEASUREMENTS AND DIMENSIONS SHOWN HEREON ARE IN FEET AND TENTHS AND HUNDREDTHS OF A FOOT, AND ARE BASED ON THE STANDARD U.S. SURVEY FOOT.
  5. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED ABOVE AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS AT THAT TIME.
  6. STANDARD FIELD CALIBRATIONS FOR EQUIPMENT WERE PERFORMED ON THIS SURVEY AND RESULTS ARE WITHIN MANUFACTURER'S SPECIFICATIONS.



5202 San Juan Ave.  
Jacksonville, Florida 32210  
Tel. (904)3848377 Fax (904)3848388  
www.arcsurveyors.com  
Licensed Business # 6487

No.	Symbol	Date	Description

Party Chief: JKM  
Dwn By: JKM  
Drawing Date: 03-07-14  
Field Bk./Pg: 13-11  
Clk By: RJS  
Survey Date: 03-05-14  
Survey Performed by:  
**BLACK & VEACH**  
1120 SANCTUARY PARKWAY, SUITE 200  
ALPHARETTA, GA 30009

MITCHELL COUNTY, GEORGIA

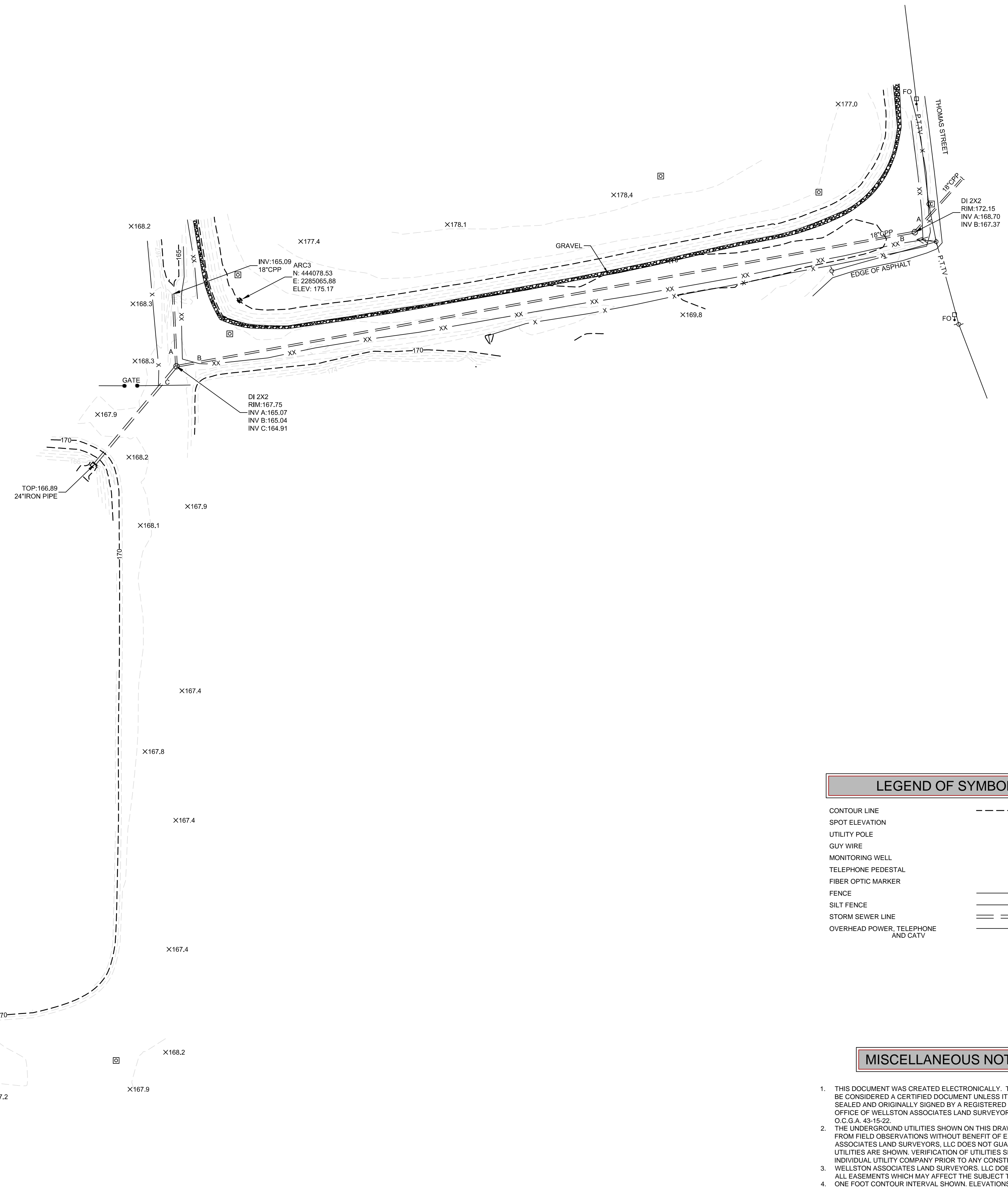
**SPECIFIC PURPOSE TO SHOW  
MONITOR WELL LOCATIONS  
AND ELEVATIONS**

PROJECT NO.  
14-02-02

FILE NO.  
C-14-10

SHEET 1 OF 1

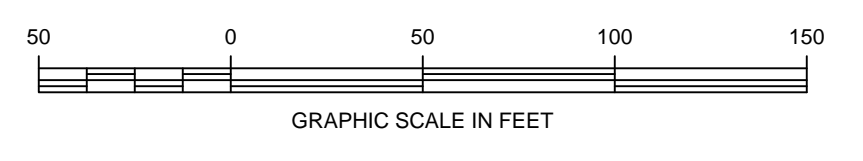
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LEGEND OF SYMBOLS	
CONTOUR LINE	--- 180 ---
SPOT ELEVATION	X166.7
UTILITY POLE	⊕
GUY WIRE	^
MONITORING WELL	⊕
TELEPHONE PEDESTAL	⊕
FIBER OPTIC MARKER	FO
FENCE	x
SILT FENCE	xx
STORM SEWER LINE	==
OVERHEAD POWER, TELEPHONE AND CATV	-P.T.TV-

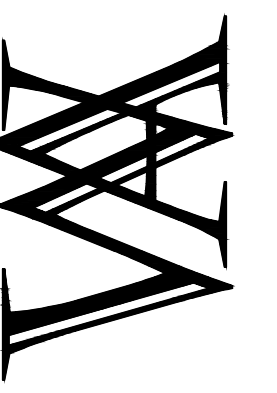
**MISCELLANEOUS NOTES**

- THIS DOCUMENT WAS CREATED ELECTRONICALLY. THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT UNLESS IT HAS BEEN PROPERLY SEALED AND ORIGINALLY SIGNED BY A REGISTERED LAND SURVEYOR AT THE OFFICE OF WELLSTON ASSOCIATES LAND SURVEYORS, LLC AUTHORITY O.C.G.A. 43-15-22.
- THE UNDERGROUND UTILITIES SHOWN ON THIS DRAWING WERE COMPILED FROM FIELD OBSERVATIONS WITHOUT BENEFIT OF EXCAVATION. WELLSTON ASSOCIATES LAND SURVEYORS, LLC DOES NOT GUARANTEE THAT ALL UTILITIES ARE SHOWN. VERIFICATION OF UTILITIES SHOULD BE MADE BY THE INDIVIDUAL UTILITY COMPANY PRIOR TO ANY CONSTRUCTION.
- WELLSTON ASSOCIATES LAND SURVEYORS, LLC DOES NOT GUARANTEE THAT ALL EASEMENTS WHICH MAY AFFECT THE SUBJECT TRACT ARE SHOWN.
- ONE FOOT CONTOUR INTERVAL SHOWN. ELEVATIONS SHOWN ARE REFERENCED TO SITE DATUM.



Revisions		
No.	Date	Description
1	8-27-14	ADJUSTED FROM NAVD 88 TO SITE DATUM

**WELLSTON ASSOCIATES  
LAND SURVEYORS, LLC**  
506 OSIGIAN BOULEVARD, SUITE 2  
WARNER ROBINS, GEORGIA 31088  
OFFICE (478) 971-3382  
FAX (478) 971-1400



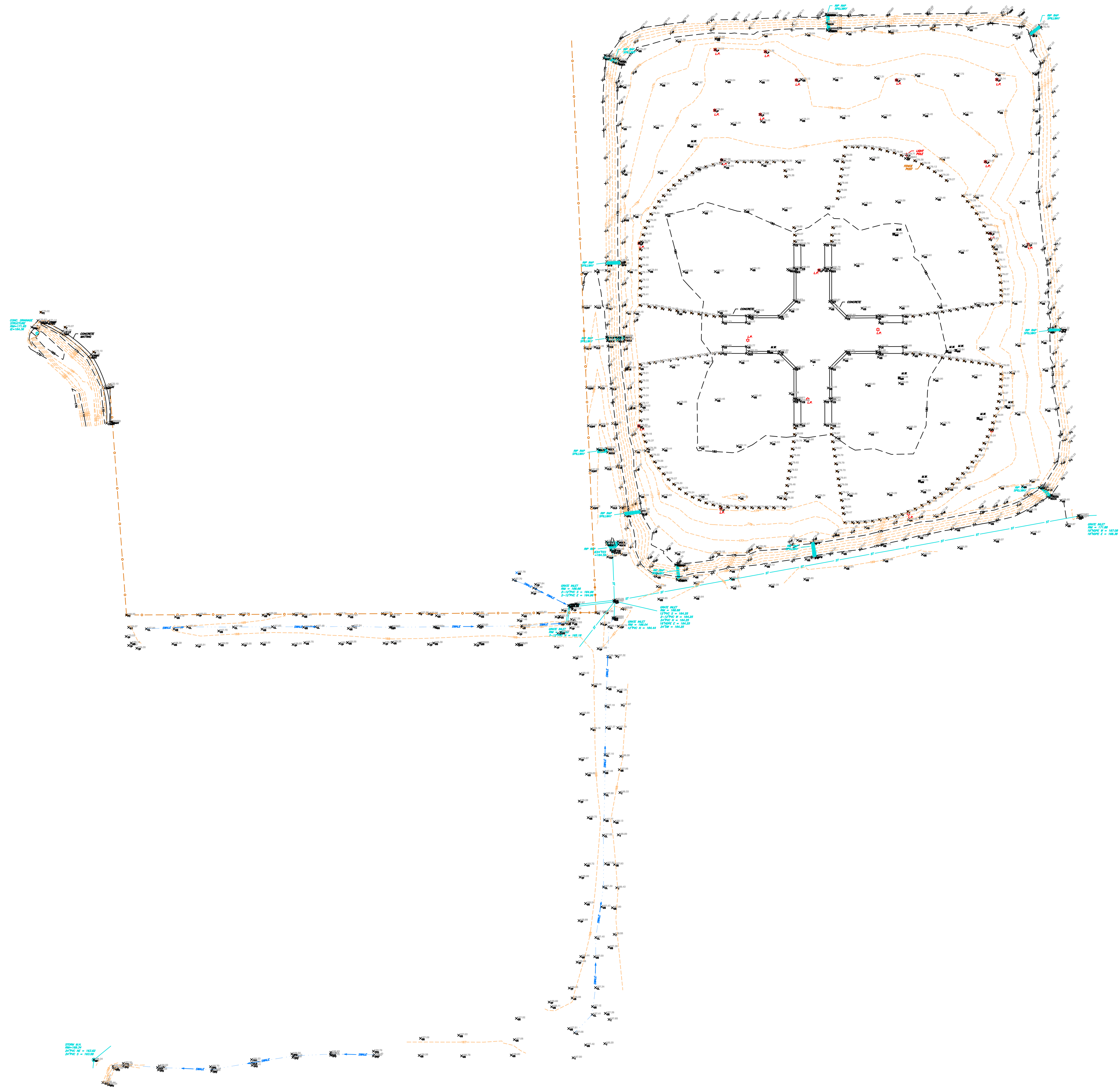
TOPOGRAPHIC SURVEY  
FOR  
**CAMILLA WOOD PRESERVING SITE**  
GEOSYNTEC CONSULTANTS  
CAMILLA  
MITCHELL COUNTY  
GEORGIA

Project No.: 1027-026  
Drawing No.: TS  
Drawn By: MH  
Checked By: SHJ  
R.L.S. No.: 3171

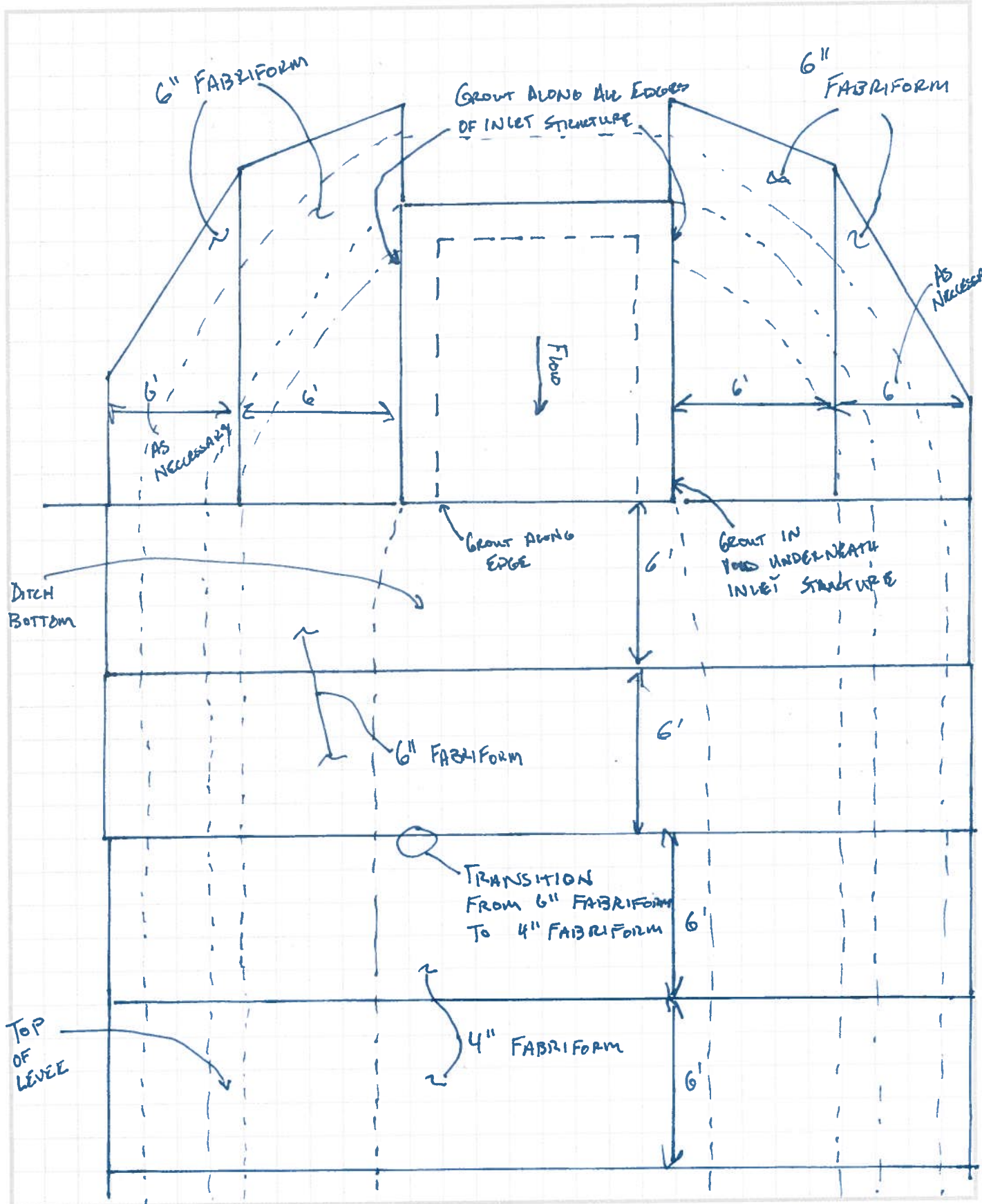
Date: 8-13-14  
Scale: 1"=50'

Sheet No.:  
**1 of 1**

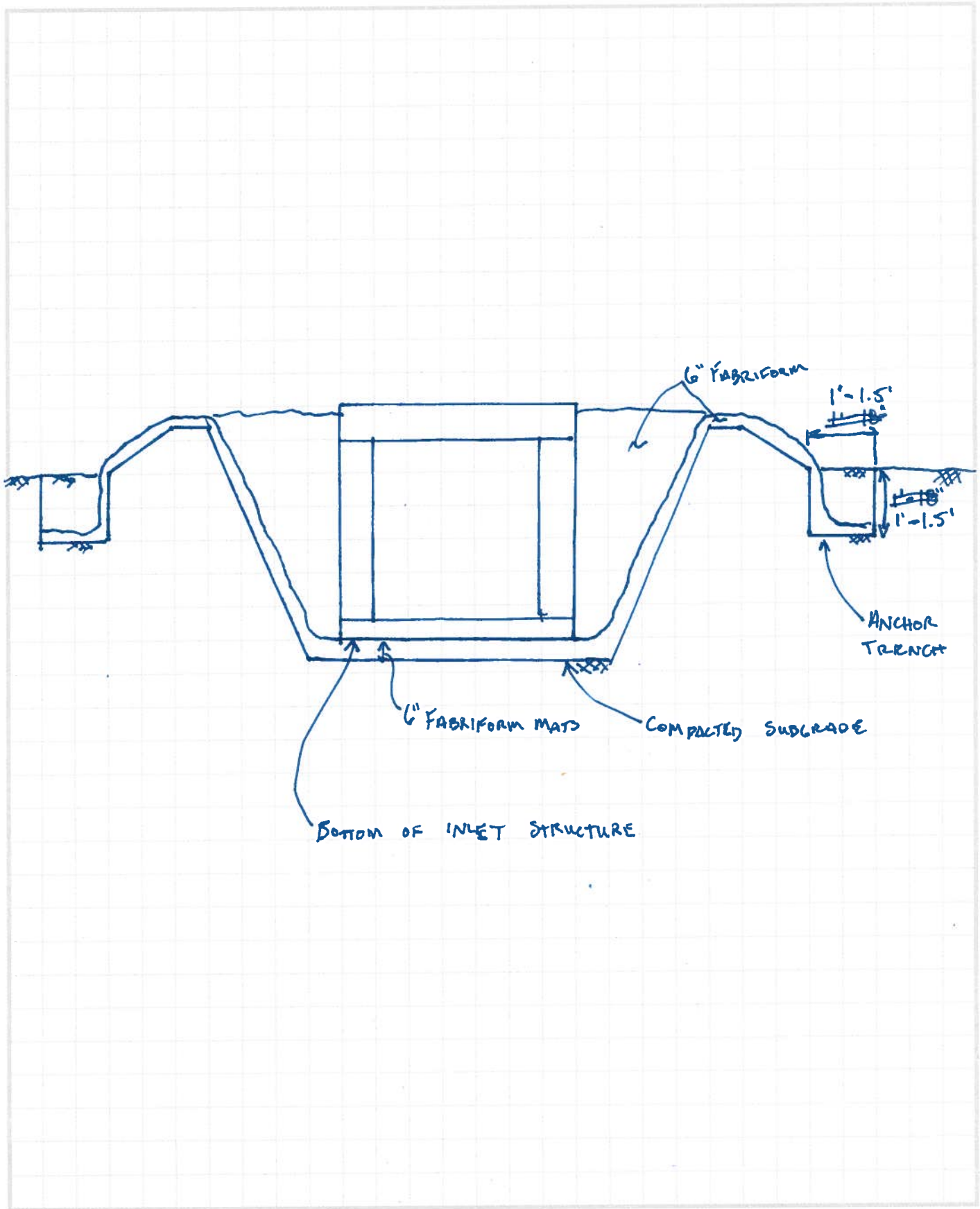
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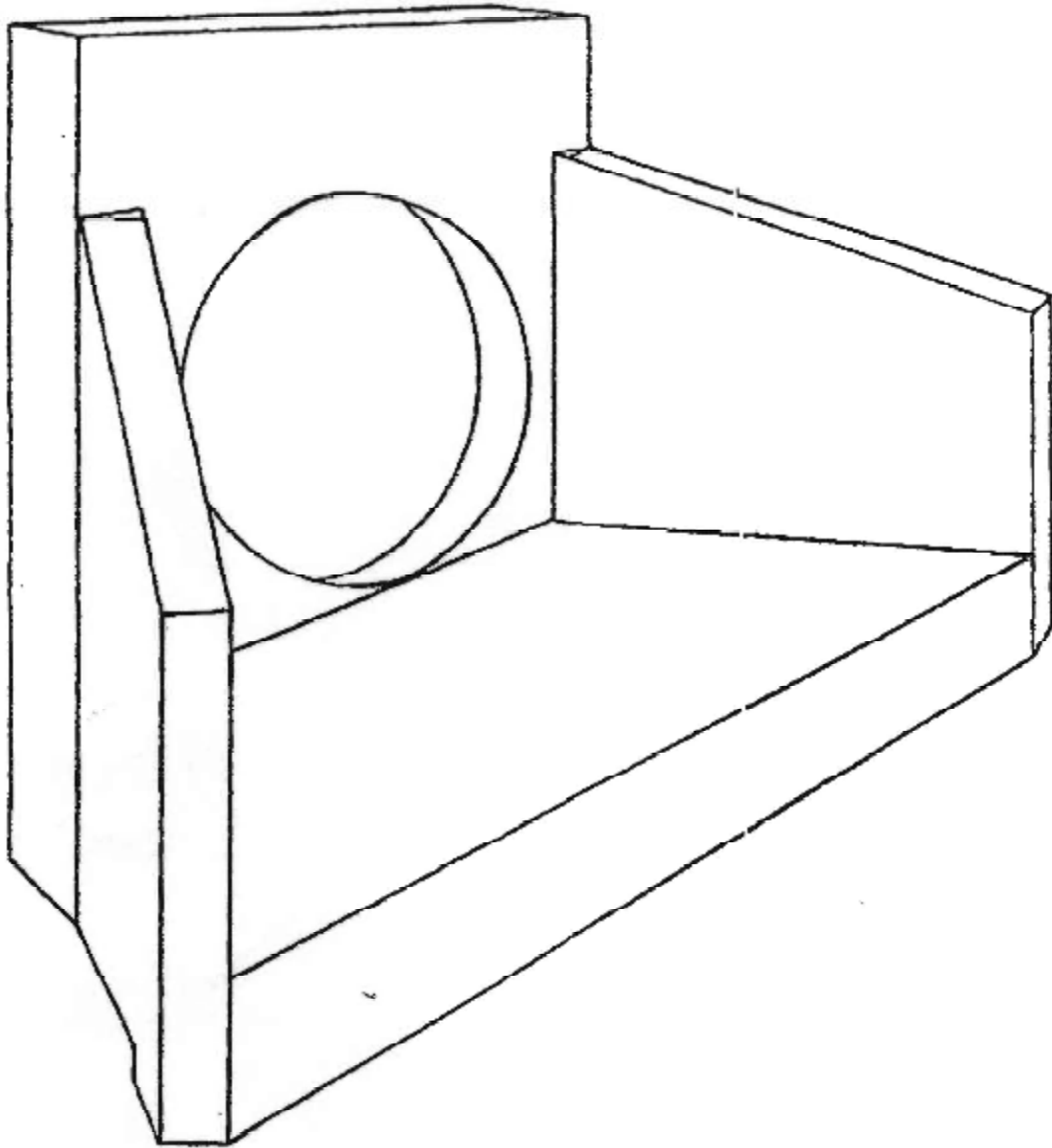
Revised, Superseded, and Void Calculations Must Be Clearly Identified, Initialed, and Dated by the Responsible Individual.



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## Appendix B. Equipment Details

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- AVAILABLE WITH CORRUGATED METAL PIPE STUB CAST-IN OR WITH OVERSIZE HOLE FOR CONCRETE PIPE.

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## **PRECAST REINFORCED CONCRETE HEADWALLS**



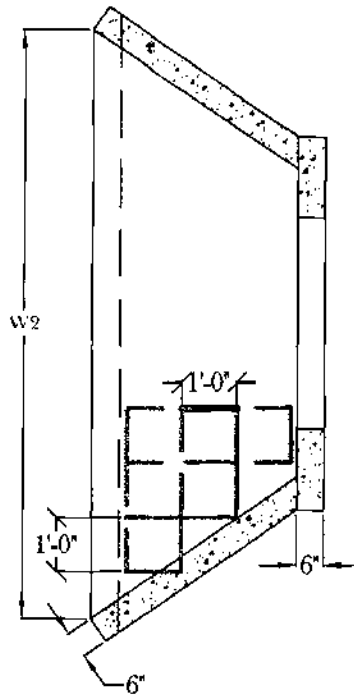
**PRECAST & PIPE**  
DALLAS, GEORGIA  
**770-445-6521**

Fax: 770-445-8293

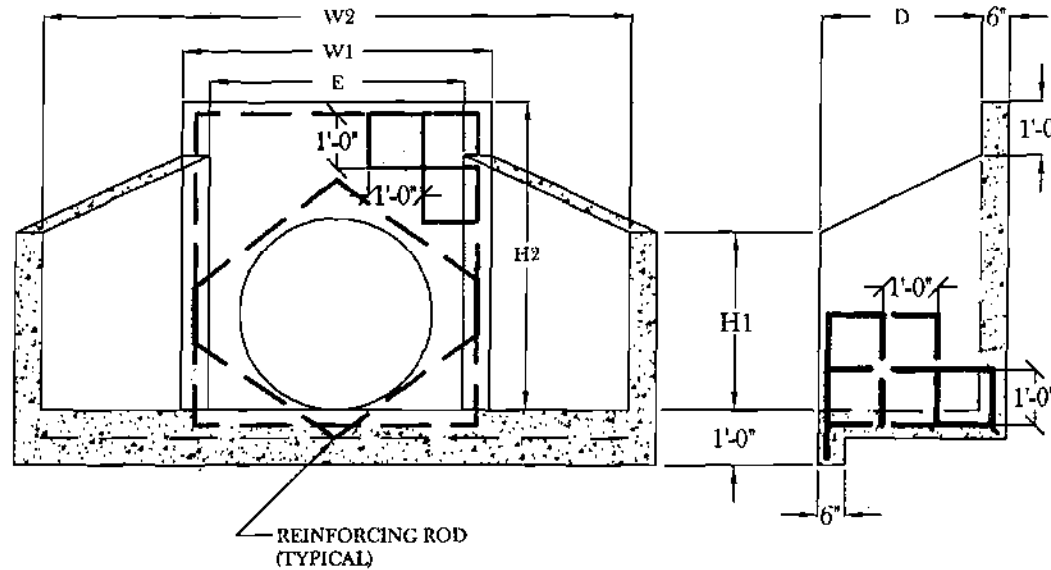
P.O. Box 948 - Dallas, GA 30132

- NOTES:  
 1. USE NEXT LARGER SIZE FOR CONCRETE PIPE  
 2. ALL CONCRETE TO BE 4,000 PSI  
 3. ALL EXPOSED EDGES TO HAVE 3/4" CHAMFER  
 4. NO. 4 REINFORCING ROD TO BE USED IN ALL HEADWALLS

RCP Pipe		HEADWALL DIMENSION								
I. D.	Hole Size	INSIDE DIA. PIPE	W1	W2	H1	H2	D	E	WT. (LBS)	SQ. FT. BASE AREA
12"	18"	12",15",18"	3'-2"	4'-10"	1'-3"	3'-2"	1'-3"	1'-9"	1,550	7.34
15"	24"	21",24"	3'-8"	6'-1"	1'-9"	3'-8"	1'-6"	2'-3"	2,100	9.90
18"	26"	30"	4'-2"	7'-2"	2'-0"	4'-2"	1'-10"	2'-9"	2,850	13.50
24"	36"	36"	4'-8"	8'-4"	2'-4"	4'-8"	2'-2"	3'-3"	3,700	17.65
30"-36"	42"-48"	42",48"	5'-8"	10'-10"	3'-3"	5'-8"	2'-11"	4'-3"	5,600	28.60
42"-48"	54"-60"	54",60"	6'-10"	11'-9"	3'-6"	6'-8"	3'-4"	5'-2"	7,500	36.27
54"	72"	66",72"	8'-1"	12'-0"	3'-8"	7'-7"	3'-4"	6'-2"	8,500	40.00
60"	78"	84",90"	9'-4"	12'-8"	4'-0"	9'-0"	3'-4"	7'-6"	10,000	44.00
72"	96"	84",96"	10'-2"	17'-4"	6'-0"	10'-0"	4'-0"	9'-0"	12,000	47.00



PLAN



SECTION



PRECAST & PIPE  
 DALLAS, GEORGIA  
**770-445-6521**

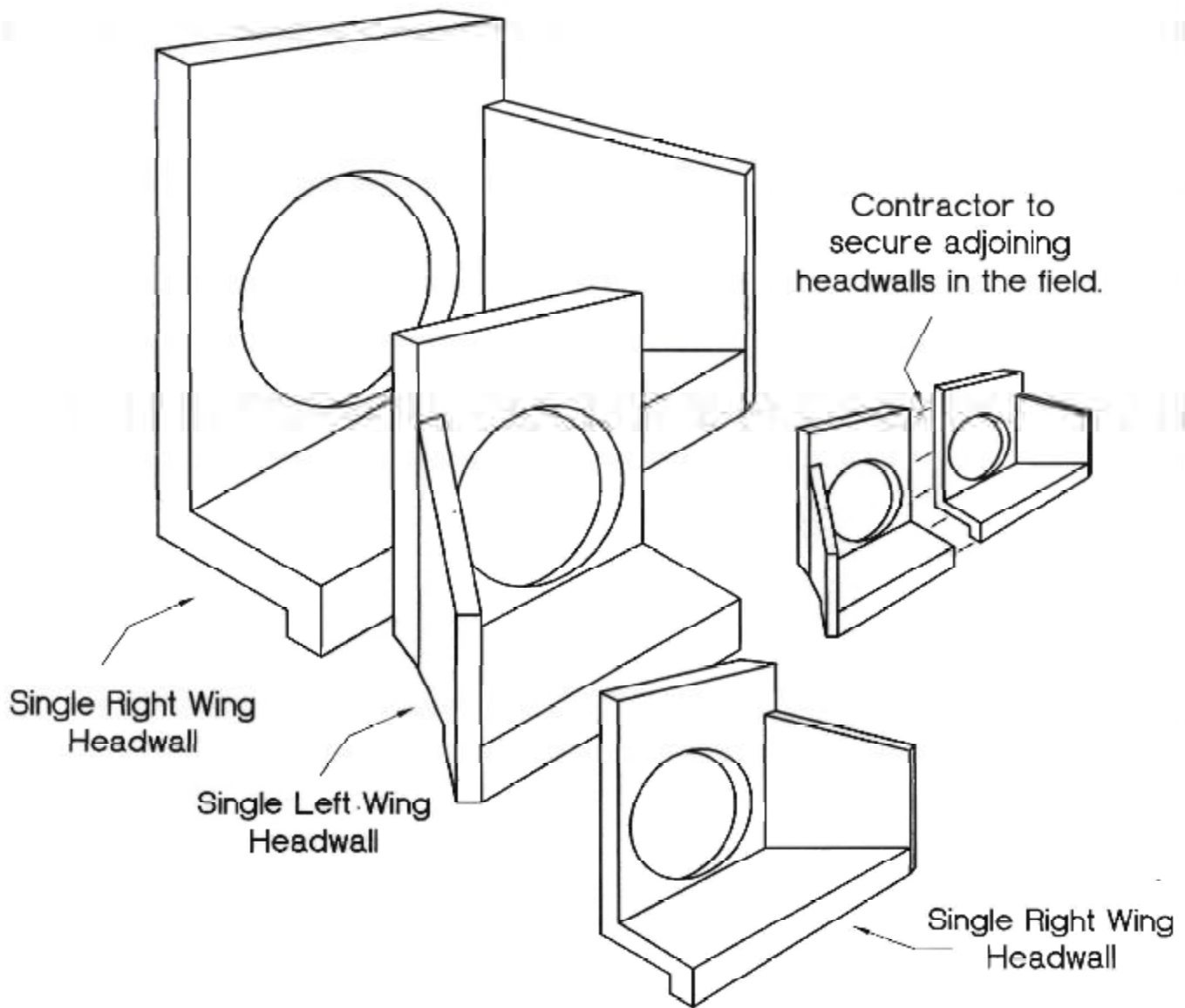
Fax: 770-445-8293

P.O. Box 948 - Dallas, GA 30132

Project:

Contractor:

STANDARD  
 PRECAST HEADWALL



Available With Corrugated Metal Pipe Stub Cast In Or With Oversize Hole For Concrete Or Plastic Pipe



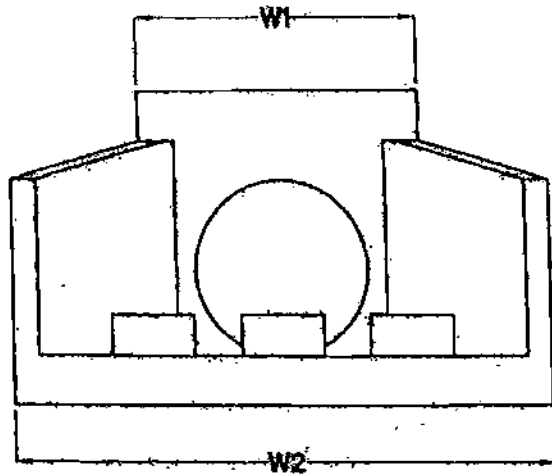
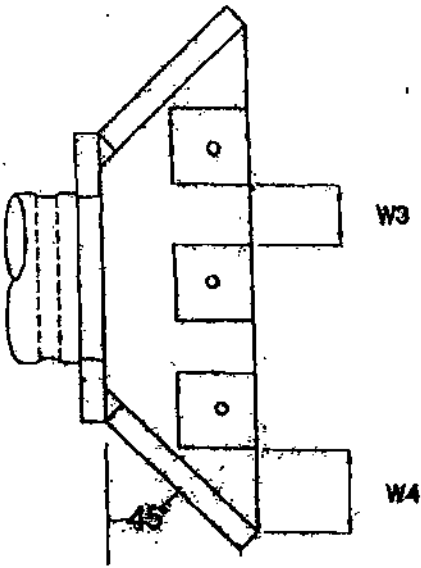
**PRECAST & PIPE**  
DALLAS, GEORGIA  
**770-445-6521**

Fax: 770-445-8293

P.O. Box 848 - Dallas, GA 30132

## Precast Concrete Double Run Headwalls

SECTION	DATE 02-21-06	REVISION
SCALE NTS	DRAWN BY	PAGE #



4000 PSI Concrete Standard

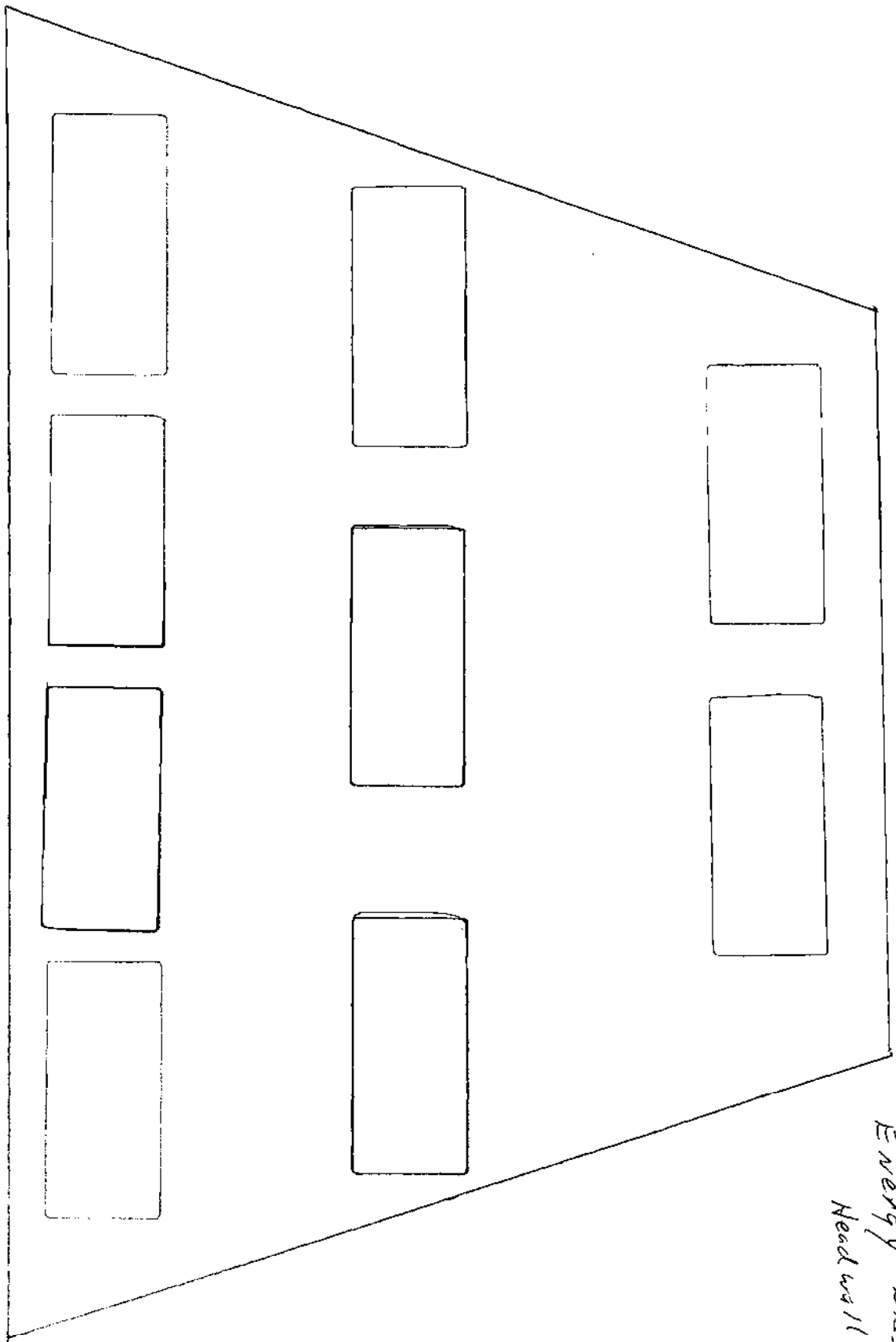
DIMENSIONS: HEADWALLS WITH DISSIPATORS							
INSIDE DIA. OF PIPE	W 1	W2	W3	W4	BLOCK LENGTH & WIDTH	BLOCK HEIGHT	NUMBER OF BLOCKS
12"	2'-6"	3'-9"	N/A	N/A	12" X 12"	6"	N/A
15" & 18"	3'-2"	4'-9"	6"	6'-8" VARIES	12" X 12"	6"	5
24"	4'-2"	8'-2"	6"	6'-8" VARIES	12" X 12"	6"	5
30" & 36"	4'-8"	8'-8"	6"	6'-8" VARIES	12" X 12"	6"	5
42" & 48"	5'-8"	10'-11"	6"	6'-8" VARIES	12" X 12"	6"	9
54" & 60"	6'-5"	12'-6"	6"	6'-8" VARIES	12" X 12"	6"	9
66" & 72"	8'-5"	13'-5"	6"	6'-8" VARIES	12" X 12"	6"	9
78", 84", 90", & 96"	10'-2"	15'-10"	6"	6'-8" VARIES	12" X 12"	6"	11

42' end of

9 Blocks

8W large

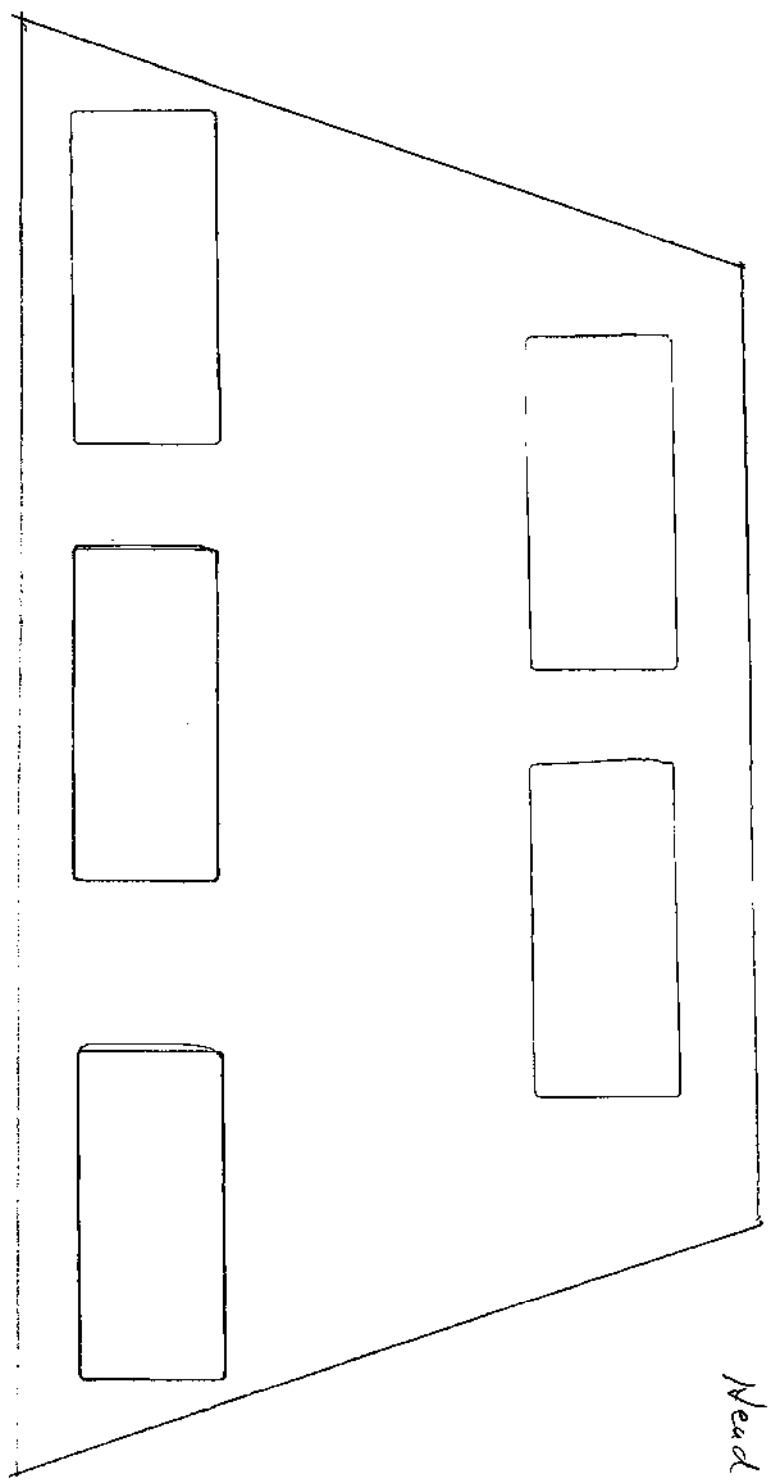
Energy Dissipator  
Headwalls



12' to 36'

5 BLOCKS  
ON SMALL

ENERGY DISSIPATOR  
Need walls



# PF-25 CAST IRON FLAP VALVES

FOR PUMP DISCHARGE

## FLANGE STYLE

Waterman Model PF-25 flap valves are designed for use on pump discharge lines and other pipe end closures to prevent entrance of back water. These valves are furnished with a variety of frame styles to fit most installation needs. A  $7\frac{1}{2}^\circ$  inclined seating plane is used to ensure that the valve will not "hang open" from slight pipe sagging or off grade. A positive stop prevents over opening.

The flange model (PF-25F) may be furnished with either iron or bronze seat faces. Bronze hinge pins are standard. Drilling is ANSI 125 lb. standard.

- Cast Iron Body
- Flange or Compression Mounted
- Cast Iron Cover
- Aluminum Cover Optional
- Cast Iron, Bronze or Resilient Seat Faces
- Bronze Hinge Pins
- $7\frac{1}{2}^\circ$  Seating Plane

## COMPRESSION STYLE

The popular compression model (PF-25W) uses time proven wedge type seals to install quickly and easily on plain end standard steel pipe. A special gasket is furnished for use with O.D. sized steel pipe. This model is standard with a cast iron frame with machined seat face and a cast iron cover with a resilient neoprene rubber seat face. Follow ring is cast iron with rubber wedge gasket and plated steel draw bolts.

Valves are available with aluminum covers and neoprene seat faces where extra sensitivity is desired. Taper setting collars can be provided as an aid for installation on concrete pipe.

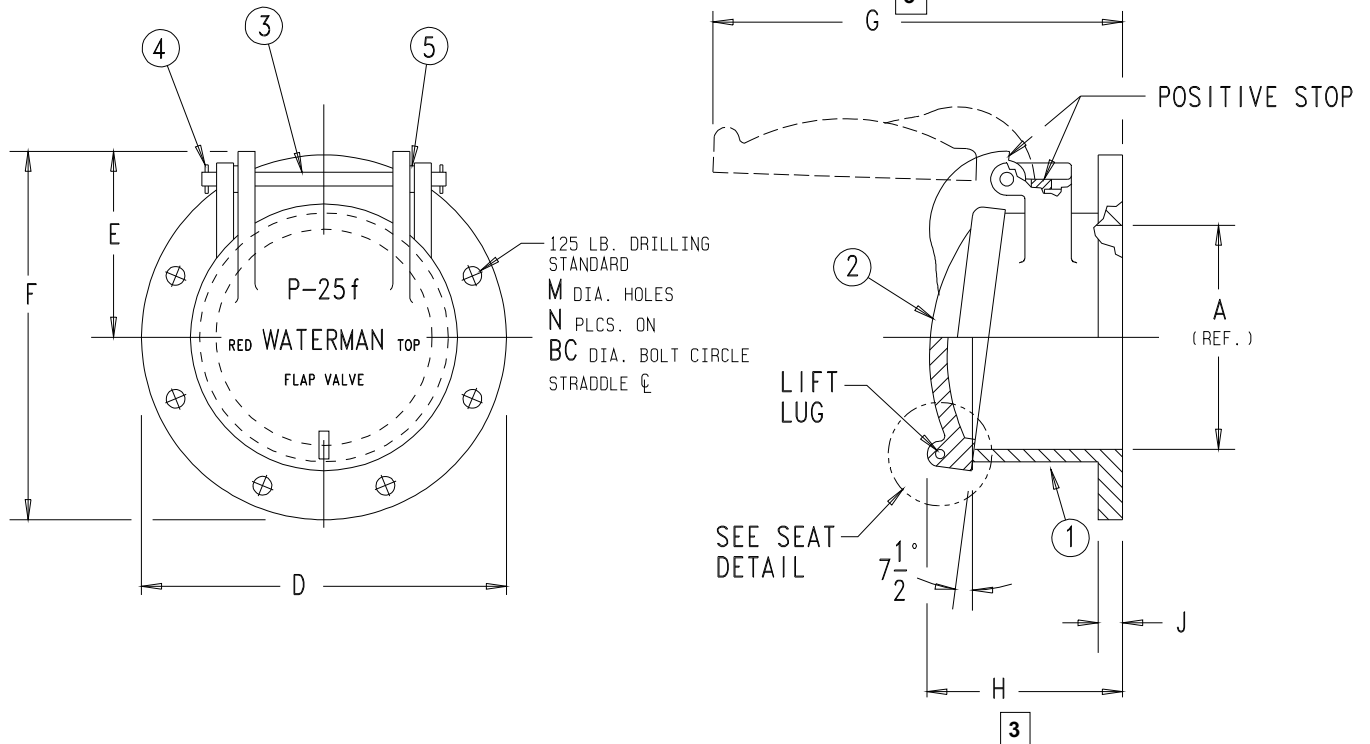


Model PF-25F



Model PF-25W

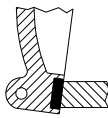
# PF-25F FLAP VALVE



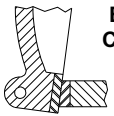
## ALTERNATE SEATS AVAILABLE



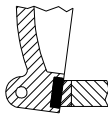
**MACHINED IRON**



**RESILIENT SEAT  
IN COVER.  
MACHINED IRON  
SEAT BODY\***



**BRONZE SEAT  
COVER & BODY**



**RESILIENT SEAT  
IN COVER.  
BRONZE SEAT  
IN  
FRAME**

\*standard configuration

## PARTS LIST

No.	Name
1	BODY(flanged)
2	COVER
3	HINGE PIN
4	SPRING PIN
5	WASHER

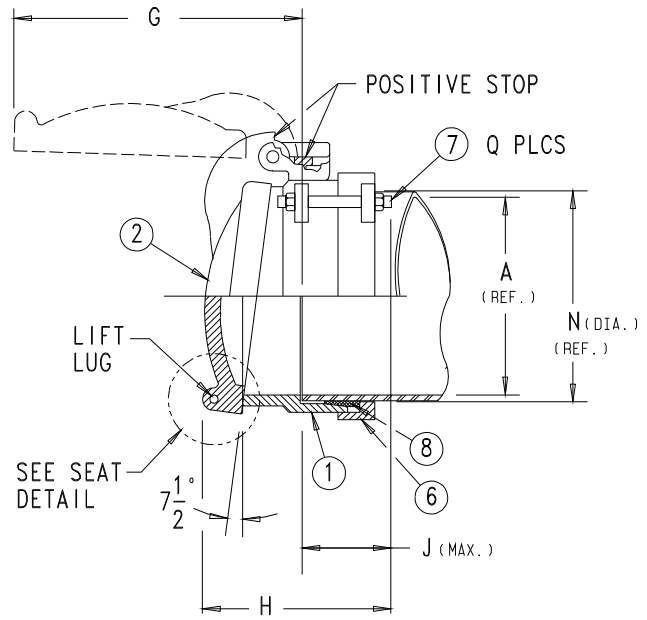
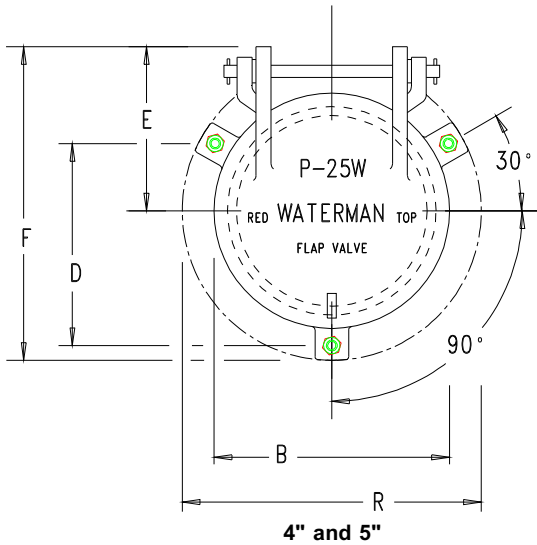
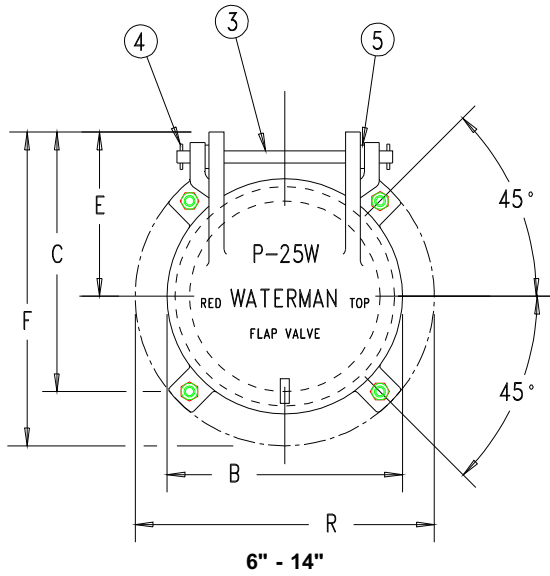
1. Designed for use on pump discharge lines.

2. 25 Lb. drilling available on request.

3. If grout pad mounting is used, add grout thickness to dimensions.

GATE DIMENSIONS IN INCHES										
GATE SIZE	4	6	8	10	12	14	16	18	20	24
A	4	6	8	10	12	14	16	18	20	24
BC	7 1/2	9 1/8	11 3/4	14 1/4	17	18 3/4	21 1/4	22 3/4	25	29 1/2
D	9	11	13 1/2	16	19	21	23 1/2	25	27 1/2	32
E	4 5/8	5 11/16	6 7/8	8 1/8	9 3/8	10 7/16	11 5/8	12 1/4	13 3/8	15 1/2
F	9 1/8	11 3/16	13 5/8	16 1/8	18 7/8	20 15/16	23 3/8	24 3/4	27 1/8	31 1/2
G	8 1/4	11 7/8	14 1/4	16 1/4	18 5/8	22 1/4	24 1/4	26 1/4	28 3/4	32 3/4
H	6 1/4	7 5/8	8	8	8 1/2	10 1/2	10 1/2	10 1/2	11	11
J	1	1	1	1	1	1	1	1 1/8	1 1/8	1 1/4
M	3/4	7/8	7/8	1	1	1 1/8	1 1/8	1 1/4	1 1/4	1 3/8
N	8	8	8	12	12	12	16	16	20	20

# PF-25W FLAP VALVE



**MACHINED IRON**

**RESILIENT SEAT IN COVER. MACHINED IRON SEAT BODY**

**BRONZE SEAT COVER & BODY**

**RESILIENT SEAT IN COVER. BRONZE SEAT IN BODY.**

**ALTERNATE SEATS AVAILABLE**

GATE DIMENSIONS IN INCHES							
GATE SIZE	4	5	6	8	10	12	14
A	4	5	6	8	10	12	14
B	5 5/8	6 3/4	8	9 7/8	12 1/2	14 1/2	16
C	-	-	6	7 1/2	9 1/8	10 1/2	12
D	4 1/2	5 1/2	-	-	-	-	-
E	5 1/4	5 1/2	6	7 1/2	8 1/4	9 1/2	10 1/2
F	9	9 1/2	10	12 1/4	14 1/4	17	18 1/2
G	7	8 3/8	9 3/4	11 3/4	14	16 1/2	18 1/4
H	5 1/4	5 1/4	6 1/4	6 1/4	6 1/2	7	7 1/2
J	2	2 1/4	2 5/8	2 5/8	2 5/8	2 5/8	2 5/8
N	4 5/8	5 5/8	6 3/4	8 3/4	10 7/8	12 7/8	14 1/8
Q	3	3	4	4	4	4	4
R	6 1/2	8	9 3/8	11 3/4	13 7/8	15 7/8	17 5/8

1. Designed for use on pump discharge lines.

PARTS LIST	
No.	Name
1	BODY (standard)
2	COVER
3	HINGE PIN
4	SPRING PIN
5	WASHER
6	FOLLOW RING
7	RING BOLT, NUT & WASHER
8	PIPE SEAL GASKET (compression gasket)

## TYPICAL SPECIFICATIONS PF-25 FLAP GATE

### General

The Flap gate shall be designed to allow free outflow and prevent backflow for maximum seating heads up to 25 feet. Flap Gates shall be Waterman Model PF-25 or Equal.

### Construction

The frame shall be of cast Iron (ASTM A-126 Class B) and shall be the flangeback or compression type, as indicated on the plans. The seating face shall be inclined from vertical at an angle of 7½ degrees to assure a positive closure. For flangeback gates that are to be mounted on flanges or on thimbles, the frame shall be drilled to match. For compression type frames, a cast iron follow ring with neoprene pipe seal gasket will be included along with plated steel draw bolts to effect a tight seal between the gate and pipe.

The cover shall be cast iron (ASTM A-126 Class B) or cast aluminum (ASTM B-26) and shall be domed to withstand the seating head specified. An integral cast lifting eye shall be included for manual operation.

The seating surfaces on the frame and cover shall be: Bronze on frame and neoprene in cover **or** machined iron on frame and neoprene on cover. All machined seats shall have a minimum 63 microinch finish.

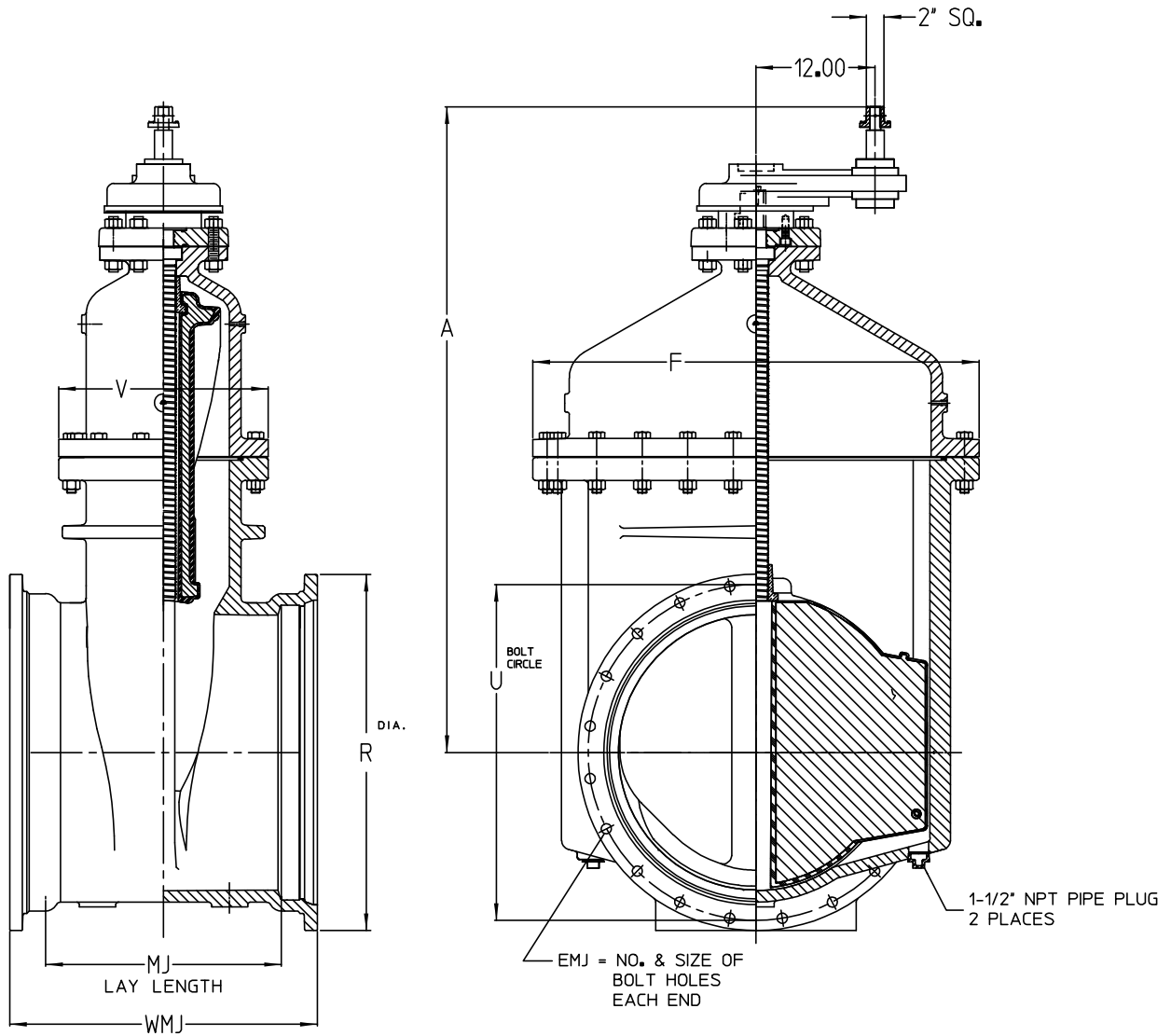
The hinge links shall be cast as one piece with the cover and shall be attached to the frame by means of a bronze hinge pin. A positive stop shall be included to prevent over-opening of the cover.

### Finish

All cast iron shall be painted with manufacturers standard shopcoat paint (or paint as specified). All other parts will not require any further finish.

# AMERICAN Flow Control Submittal Information

## 20" - 24" SERIES 2500 RESILIENT WEDGE GATE VALVE NRS MECHANICAL JOINT ENDS WITH SPUR GEAR ACTUATOR (MJ X MJ)



91-21406

Size	20"	24"
A	49.50	57.63
EMJ	14 - .88	16 - .88
F	34.50	39.00
MJ	16.50	18.63
R	27.13	31.75
U	25.50	30.00
V	16.25	17.75
WMJ	23.50	25.63
Turns to Open	186	228
Weight	1570 lbs.	2350 lbs.



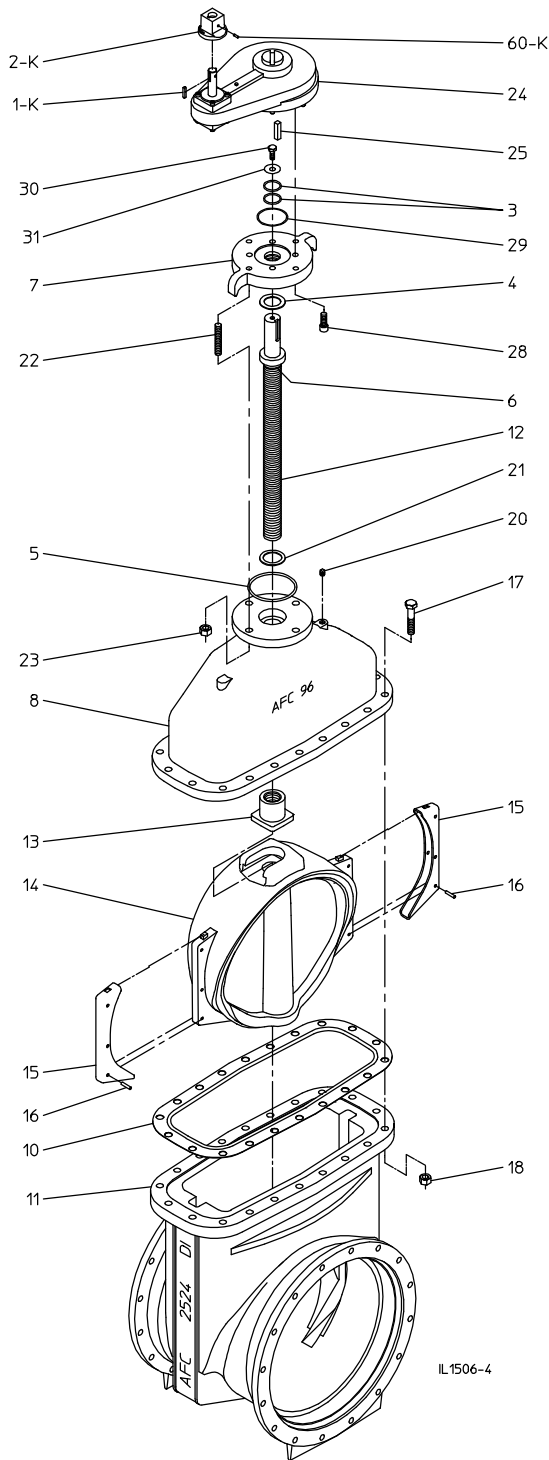
**AMERICAN**  
FLOW CONTROL

**THE RIGHT WAY**

AMERICAN Flow Control  
P.O. Box 2727  
Birmingham, Al. 35202-2727  
Phone: 1-800-326-8051  
Fax: 1-800-610-3569  
E-mail: [afcsales@american-usa.com](mailto:afcsales@american-usa.com)

Waterous Company  
125 Hardman Avenue South  
South St. Paul, Mn. 55075-1191  
Phone: 1-888-266-3686  
Fax: 1-800-601-2809  
E-mail: [afcsales@american-usa.com](mailto:afcsales@american-usa.com)

[WWW.AMERICAN-USA.COM](http://WWW.AMERICAN-USA.COM)



Ref. No.	Description	Material
1-K	Key for operating nut	Steel
2-K	Operating Nut	Ductile Iron ASTM A536
3	O-Ring	Rubber
4	Upper Thrust Washer	Delrin
5	Stuffing Box Gasket	Rubber O-Ring
6	O-Ring	Rubber
7	Stuffing Box	Ductile Iron ASTM A536
8	Bonnet	Ductile Iron ASTM A536
10	Throat Flange Gasket	Rubber
11	Valve Body	Ductile Iron ASTM A536
12	Stem	Manganese Bronze, ASTM B763, UNS C86700
13	Wedge Nut	Manganese Bronze, ASTM B584, UNS C87600
14	Resilient Wedge	EPDM Rubber Encapsulated Ductile Iron ASTM A536
15	Wedge Cover	Acetal Polymer
16	Wedge Cover Pin	Acetal Polymer
17	Hex Head Bolt	304 Stainless Steel
18	Hex Nut	304 Stainless Steel
20	Pipe Plug	Stainless Steel
21	Lower Thrust Washer	Delrin
22	Stud	304 Stainless Steel
23	Hex Nut	304 Stainless Steel
24	Spur Gear Actuator	Rotork IS-7 (3:1)
25	Key	Hardened Steel
28	Socket Head Capscrew	304 Stainless Steel
29	Actuator Gasket	Rubber O-Ring
30	Hex Head Bolt	304 Stainless Steel
31	Washer	Steel
60-K	Pin for Operating Nut	Stainless Steel

#### OPTIONAL MATERIALS ARE AS FOLLOWS

BOLTS and NUTS: 316 Stainless Steel  
 STEM: Cast NDZ-S Bronze, ASTM B763, UNS C99500  
 STEM: Stainless Steel

Open Direction  Left(C.C.W.)  Right(C.W.)

Construction shown is typical of the 24-inch size with mechanical joint end connections and is illustrative only. Construction of other sizes and end connection types vary slightly. See elsewhere on this drawing for specific details.

#### NOTES:

1. Mechanical joint ends are in accordance with ANSI/AWWA C111/A21.11.
2. Fusion -bonded epoxy coated in accordance with AWWA C550.
3. Certified to ANSI/NSF Standard 61.
4. Meets requirements of AWWA C515 with rated working pressure of 250 psig.



**AMERICAN**  
FLOW CONTROL

**THE RIGHT WAY**

AMERICAN Flow Control  
 P.O. Box 2727  
 Birmingham, Al. 35202-2727  
 Phone: 1-800-326-8051  
 Fax: 1-800-610-3569  
 E-mail: [afcsales@american-usa.com](mailto:afcsales@american-usa.com)

Waterous Company  
 125 Hardman Avenue South  
 South St. Paul, Mn. 55075-1191  
 Phone: 1-888-266-3686  
 Fax: 1-800-601-2809  
 E-mail: [afcsales@american-usa.com](mailto:afcsales@american-usa.com)

[WWW.AMERICAN-USA.COM](http://WWW.AMERICAN-USA.COM)

## Product Description

DURA•SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA•SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

## Product Use

DURA•SKRIM® K30B, K36B and K45B are used in applications that require exceptional outdoor life and demand high tear strength and resistance to thermal expansion.

DURA•SKRIM® K30B, K36B and K45B are manufactured from a very chemical-resistant, Linear Low Density Polyethylene with excellent cold crack performance.

## Size & Packaging

DURA•SKRIM® K30B, K36B and K45B are available in a variety of widths and lengths to meet the project requirements. Large diameter mill rolls are available to assure an efficient seaming process. Factory welded panels are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time saving installation.



Containment Liner

Product	Part #
DURA•SKRIM .....	K30B
DURA•SKRIM .....	K36B
DURA•SKRIM .....	K45B

## APPLICATIONS

- Waste Lagoon Liners
- Floating Covers
- Daily Landfill Covers
- Modular Tank Liners
- Tunnel Liners
- Remediation Liners
- Earthen Liners
- Interim Landfill Covers
- Remediation Covers
- Landfill Caps
- Erosion Control Covers
- Canal Liners
- Disposal Pit Liner
- Water Containment Ponds
- Heap Leach Liner

# DURA♦SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene

PRO-FORMA DATA SHEET

PROPERTIES	TEST METHOD	DURA♦SKRIM K30B		DURA♦SKRIM K36B		DURA♦SKRIM K45B	
		Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages
<b>APPEARANCE</b>		Black	Black	Black	Black	Black	Black
<b>THICKNESS</b>		27 mil	30 mil	32 mil	36 mil	40 mil	45 mil
<b>WEIGHT</b> LBS/MSF, (OZ/YD <sup>2</sup> )		116 (16.7)	125 (18.0)	136 (19.6)	155 (22.3)	175 (25.2)	200 (28.8)
<b>CONSTRUCTION</b>		Dense scrim reinforced polyethylene					
<b>*PLY ADHESION - LBF/IN</b>	ASTM D 6636	17 or FTB	20 or FTB	21 or FTB	28 or FTB	24 or FTB	32 or FTB
<b>TENSILE STRENGTH - LBF/IN</b>	ASTM D 7003	165 MD 159 TD	182 MD 170 TD	170 MD 166 TD	186 MD 175 TD	178 MD 170 TD	195 MD 180 TD
<b>TENSILE ELONGATION AT BREAK %</b> (FILM BREAK)	ASTM D 7003	480 MD 430 TD	540 MD 500 TD	500 MD 450 TD	575 MD 520 TD	520 MD 470 TD	590 MD 550 TD
<b>TENSILE ELONGATION AT BREAK %</b> (SCRIM BREAK)	ASTM D 7003	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD
<b>TONGUE TEAR STRENGTH - LBF</b>	ASTM D 5884	185 MD 160 TD	195 MD 185 TD	160 MD 120 TD	180 MD 140 TD	140 MD 120 TD	175 MD 145 TD
<b>GRAB TENSILE - LBF</b> (SCRIM BREAK)	ASTM D 7004	260 MD 245 TD	270 MD 255 TD	280 MD 270 TD	300 MD 290 TD	260 MD 245 TD	270 MD 255 TD
<b>GRAB TENSILE ELONGATION AT BREAK %</b> (SCRIM BREAK)	ASTM D 7004	25	32	25	32	25	32
<b>HIGH PRESSURE OIT (HPOIT)</b>	ASTM D 5885	1000 min	2400 min	1000 min	2400 min	1000 min	2400 min
<b>PUNCTURE RESISTANCE - LBF</b>	ASTM D 4833	85	100	110	120	120	133
<b>MAXIMUM USE TEMPERATURE</b>		180° F		180° F		180° F	
<b>MINIMUM USE TEMPERATURE</b>		-70° F		-70° F		-70° F	

\*Raven modified QC procedure

PRO-FORMA Sheet Contents:

The data listed in this Pro-Forma data sheet is representative of initial production runs. These values may be revised at anytime without notice as additional test data becomes available.



DURA♦SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA♦SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage.



# C153 Mechanical Joint Ductile Iron Fittings

**C  
O  
M  
P  
A  
C  
T  
M  
J**





Weights in Pounds, Less Accessories / Dimensions in inches  
 Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

# C153 Mechanical Joint Compact Fittings

## 3-48" Ductile Iron Mechanical Joint Fittings Class 350

MATERIAL: Ductile Iron ASTM A536

PRESSURE: 350PSI WATER WORKING PRESSURE (CLASS 350) 3" - 24": & 250 PSI 30" - 48"

TESTING: In accordance with ANSI / AWWA C153 / A21.53 & UL - FM requirements

LAYING LENGTH: Short body design - straight section of body deleted to provide a compact and lighter fitting without reducing strength or flow characteristics, in accordance with ANSI / AWWA C153 / A21.53

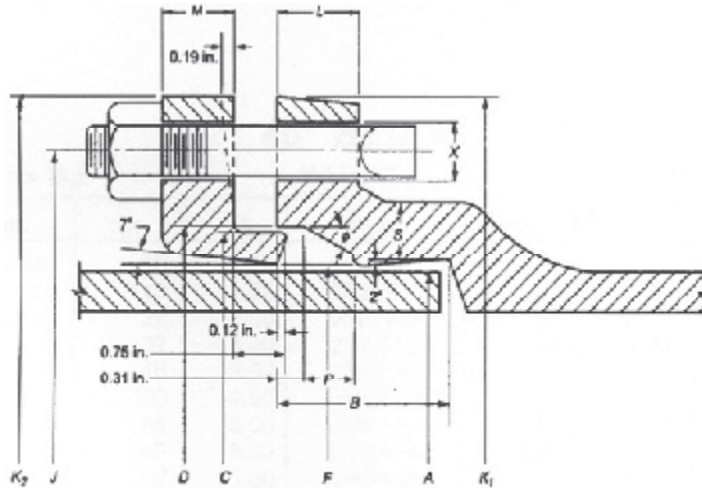
CEMENT LINING: In accordance with ANSI / AWWA C104 / A21.4 COATING: Tar coated (bituminous) inside and out in accordance with ANSI / AWWA C104 / A21.4

GASKETS: SBR in accordance with ANSI / AWWA C111 / A21.11

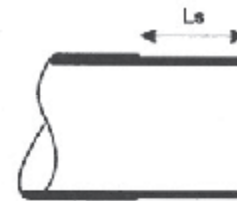
T-BOLTS: Low Alloy corrosion resistant high strength steel in accordance with ANSI / AWWA C111 / A21.11

APPROVALS: 3"-16" Underwriters Laboratories listed and Factory Mutual Approved.

STANDARDS: Certified to NSF61 Standard ANSI / AWWA C153 / A21.53 for Compact Ductile Iron Fittings 3"-48" for water and other liquids.



**Mechanical Joint Detail**



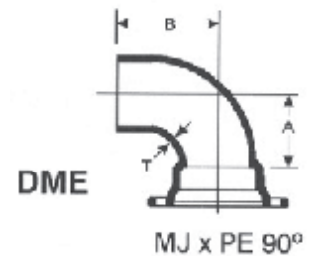
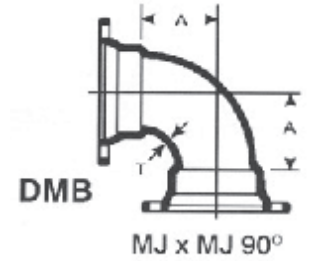
**Plain End Detail**

Size	A	B	C	D	F	J	K1	K2	L	M	P	S	X	Bolts			
														No	Size	Len	L <sub>s</sub>
3	3.96	2.50	4.84	4.94	4.06	6.19	7.62	7.69	0.58	0.62	0.63	0.39	3/4	4	5/8	3.0	5.5
4	4.80	2.50	5.92	6.02	4.90	7.50	9.06	9.12	0.60	0.75	0.75	0.39	7/8	4	3/4	3.5	5.5
6	6.90	2.50	8.02	8.12	7.00	9.50	11.06	11.12	0.63	0.88	0.75	0.43	7/8	6	3/4	3.5	5.5
8	9.05	2.50	10.17	10.27	9.15	11.75	13.31	13.37	0.66	1.00	0.75	0.45	7/8	6	3/4	3.5	5.5
10	11.10	2.50	12.22	12.34	11.20	14.00	15.62	15.62	0.70	1.00	0.75	0.47	7/8	8	3/4	3.5	5.5
12	13.20	2.50	14.32	14.44	13.30	16.25	17.88	17.88	0.73	1.00	0.75	0.49	7/8	8	3/4	3.5	5.5
14	15.30	3.50	16.40	16.54	15.44	18.75	20.25	20.25	0.79	1.25	0.75	0.55	7/8	10	3/4	4.0	8.0
16	17.40	3.50	18.50	18.64	17.54	21.00	22.50	22.50	0.85	1.31	0.75	0.58	7/8	12	3/4	4.0	8.0
18	19.50	3.50	20.60	20.74	19.64	23.25	24.83	24.75	1.00	1.38	0.75	0.68	7/8	12	3/4	4.0	8.0
20	21.60	3.50	22.70	22.84	21.74	25.50	27.08	27.00	1.02	1.44	0.75	0.69	7/8	14	3/4	4.0	8.0
24	25.80	3.50	26.90	27.04	25.94	30.00	31.58	31.50	1.02	1.56	0.75	0.75	7/8	16	3/4	4.5	8.0
30	32.00	4.00	33.29	33.46	32.17	36.88	39.12	39.12	1.31	2.00	1.00	0.82	1 1/8	20	1	5.5	8.0
36	38.30	4.00	39.59	39.76	38.47	43.75	46.00	46.00	1.45	2.00	1.00	1.00	1 1/8	24	1	5.5	8.0
42	44.50	4.00	45.79	45.96	44.67	50.62	53.12	53.12	1.45	2.00	1.00	1.25	1 3/8	28	1 1/4	6.0	8.0
48	50.80	4.00	52.09	52.26	50.97	57.50	60.00	60.00	1.45	2.00	1.00	1.35	1 3/8	32	1 1/4	6.0	8.0

# C153 Mechanical Joint Compact Fittings

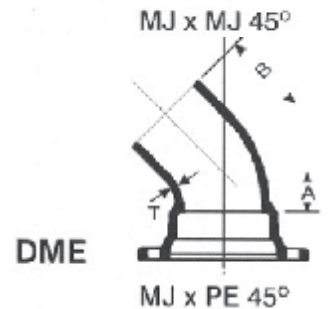
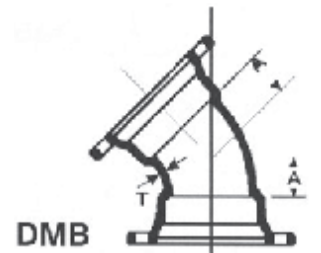
## 90 Degree Bends

MJ x MJ				MJ x PE				
Size	Item No.	Wt.	A	Item No.	Wt.	A	B	t
2	DMB290	17	3.00					0.30
3	DMB390	19	3.50	DME390	16	3.25	8.50	0.33
4	DMB490	25	4.00	DME490	22	4.00	9.50	0.34
6	DMB690	39	5.00	DME690	41	5.00	11.50	0.36
8	DMB890	57	6.50	DME890	58	6.50	12.50	0.38
10	DMB1090	89	7.50	DME1090	88	7.50	13.00	0.40
12	DMB1290	108	9.00	DME1290	114	9.00	14.50	0.42
14	DMB1490	210	11.50	DME1490	211	11.50	19.50	0.47
16	DMB1690	264	12.50	DME1690	248	12.50	20.50	0.50
18	DMB1890	335	14.00	DME1890	325	14.00	21.00	0.54
20	DMB2090	400	15.00	DME2090	390	15.00	22.50	0.57
24	DMB2490	565	16.75	DME2490	575	17.00	25.00	0.61
30	DMB3090	930	21.50	DME3090	865	21.50	30.50	0.66
36	DMB3690	1,450	24.50	DME3690	1,355	24.50	33.50	0.74
42	DMB4290	2,205	29.25	DME4290	2,055	29.25	38.25	0.82
48	DMB4890	2,990	33.25	DME4890	2,805	33.25	42.25	0.90



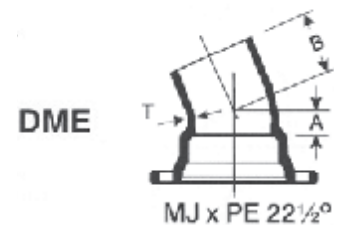
## 45 Degree Bends

MJ x MJ				MJ x PE				
Size	Item No.	Wt.	A	Item No.	Wt.	A	B	T
2	DMB245	10	1.50					0.30
3	DMB345	16	1.50	DME345	13	1.50	7.00	0.33
4	DMB445	22	2.00	DME445	19	2.00	7.50	0.34
6	DMB645	32	3.00	DME645	34	3.00	8.50	0.36
8	DMB845	46	3.50	DME845	49	3.50	9.00	0.38
10	DMB1045	70	4.50	DME1045	70	4.50	10.00	0.40
12	DMB1245	86	5.50	DME1245	93	5.50	11.00	0.42
14	DMB1445	160	5.00	DME1445	146	5.00	13.00	0.47
16	DMB1645	202	5.50	DME1645	212	5.50	13.50	0.50
18	DMB1845	250	6.00	DME1845	235	6.00	13.00	0.54
20	DMB2045	305	7.00	DME2045	290	7.00	14.00	0.57
24	DMB2445	405	7.50	DME2445	390	7.50	14.50	0.61
30	DMB3045	780	10.50	DME3045	715	10.50	19.50	0.66
36	DMB3645	1135	11.50	DME3645	1,040	12.00	21.00	0.74
42	DMB4245	1610	14.00	DME4245	1,460	14.00	23.00	0.82
48	DMB4845	2090	15.00	DME4845	1,905	15.00	24.00	0.90



## 22-1/2 Degree Bends

MJ x MJ				MJ x PE				
Size	Item No.	Wt.	A	Item No.	Wt.	A	B	T
3	DMB322	15	1.00	DME322	12	1.00	6.50	0.33
4	DMB422	18	1.50	DME422	18	1.50	7.00	0.34
6	DMB622	31	2.00	DME622	29	2.00	7.50	0.36
8	DMB822	46	2.50	DME822	43	2.50	8.00	0.38
10	DMB1022	64	3.00	DME1022	61	3.00	8.50	0.40
12	DMB1222	80	3.50	DME1222	79	3.50	9.00	0.42
14	DMB1422	136	3.75	DME1422	133	3.75	11.25	0.47
16	DMB1622	172	3.75	DME1622	166	3.75	11.75	0.50
18	DMB1822	255	4.50	DME1822	235	6.00	13.00	0.54
20	DMB2022	310	4.50	DME2022	300	7.00	14.00	0.57
24	DMB2422	412	4.50	DME2422	395	7.50	14.50	0.61
30	DMB3022	665	6.75	DME3022	600	6.75	15.75	0.66
36	DMB3622	960	7.75	DME3622	865	7.75	16.75	0.74
42	DMB4222	1350	9.00	DME4222	1,200	9.00	18.00	0.82
48	DMB4822	1760	10.00	DME4822	1,575	10.00	19.00	0.90

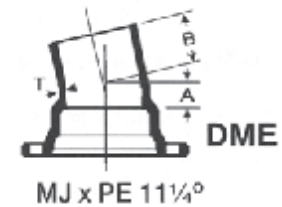
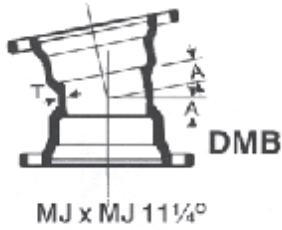




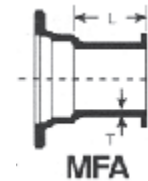
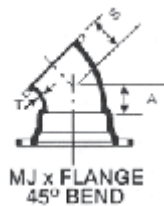
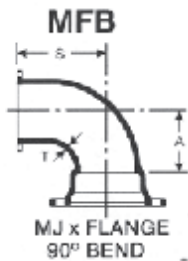
Weights in Pounds, Less Accessories / Dimensions in inches  
 Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

# C153 Mechanical Joint Compact Fittings

## 11-1/4 Degree Bends



MJ x MJ				MJ x PE				
Size	Item No.	Wt.	A	Item No.	Wt.	A	B	T
3	DMB311	14	1.00	DME311	12	1.00	6.50	0.33
4	DMB411	16	1.25	DME411	17	1.25	6.25	0.34
6	DMB611	30	1.50	DME611	27	1.50	7.00	0.36
8	DMB811	42	1.75	DME811	39	1.75	7.25	0.38
10	DMB1011	58	2.00	DME1011	52	2.00	7.50	0.40
12	DMB1211	67	2.25	DME1211	69	2.25	7.75	0.42
14	DMB1411	93	2.50	DME1411	118	2.50	10.50	0.47
16	DMB1611	148	2.50	DME1611	136	2.50	10.50	0.50
18	DMB1811	205	3.00	DME1811	235	6.00	13.00	0.54
20	DMB2011	245	3.00	DME2011	300	7.00	14.00	0.57
24	DMB2411	315	3.00	DME2411	400	7.50	14.50	0.61
30	DMB3011	600	4.75	DME3011	535	4.75	13.75	0.66
36	DMB3611	820	5.00	DME3611	725	5.00	14.00	0.74
42	DMB4211	1,180	6.00	DME4211	1,030	6.00	15.00	0.82
48	DMB4811	1,475	6.50	DME4811	1,290	6.50	15.50	0.90



## MJ x Flange Bends & Adapters

### 90 deg. bends

### 45 deg. bends

### Adapters

Size	Item No.	A	S	Wt.	Item No.	A	S	Wt.	Item No.	L	Wt.	T
3	MFB390	3.50	5.50	21	MFB345	1.50	3.00	17	MFA3	3.50	18	0.33
4	MFB490	4.00	6.50	28	MFB445	2.00	4.00	34	MFA4	3.50	24	0.34
6	MFB690	5.00	8.00	46	MFB645	3.00	5.00	57	MFA6	3.50	36	0.36
8	MFB890	6.50	9.00	71	MFB845	3.50	5.50	83	MFA8	4.00	52	0.38
10	MFB1090	7.50	11.00	121	MFB1045	4.50	6.50	122	MFA10	4.00	67	0.40
12	MFB1290	9.00	12.00	155	MFB1245	5.50	7.50	159	MFA12	4.00	80	0.42
14									MFA14	5.00	126	0.47
16	MFB1690	12.50	15.00	280	MFB1645	5.50	8.00	290	MFA16	5.00	166	0.50
18									MFA18	5.00	206	0.54
20	MFB2090	15.00	18.00	441	MFB2045	7.00	9.50	338	MFA20	5.00	275	0.57
24	MFB2490	16.75	22.00	618	MFB2445	7.50	11.00	442	MFA24	5.00	324	0.61
30									MFA30	7.00	420	0.66



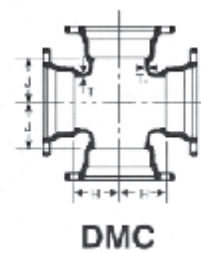
## MJ x Flange 22-1/2 Bends

Size	Item No.	A	S	T	Wt.
3	MFB322	1.00	3.00	0.33	15
4	MFB422	1.50	4.00	0.34	23
6	MFB622	2.00	5.00	0.36	37
8	MFB822	2.50	5.50	0.38	56
10	MFB1022	3.00	6.50	0.40	81
12	MFB1222	3.50	7.50	0.42	114

# C153 Mechanical Joint Compact Fittings

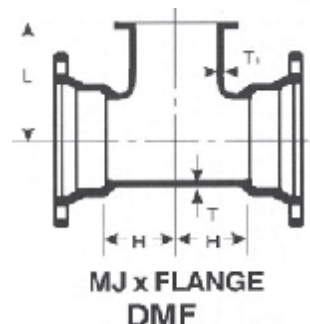
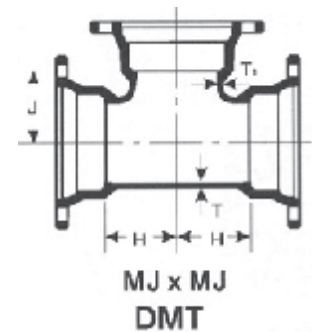
## Crosses

Size		Item No.	H	J	T	T1	Wt.
Run	Branch						
3	3	DMC33	3.00	3.00	0.33	0.33	35
4	3	DMC43	3.50	4.00	0.34	0.33	49
4	4	DMC44	4.00	4.00	0.34	0.34	57
6	4	DMC64	4.00	5.00	0.36	0.34	68
6	6	DMC66	5.00	5.00	0.36	0.36	75
8	4	DMC84	4.00	6.50	0.38	0.34	99
8	6	DMC86	5.00	6.50	0.38	0.36	108
8	8	DMC88	6.00	6.00	0.38	0.38	105
10	3	DMC103	3.00	7.50	0.40	0.33	115
10	4	DMC104	4.00	7.50	0.40	0.34	98
10	6	DMC106	5.00	7.50	0.40	0.36	118
10	8	DMC108	6.50	7.50	0.40	0.38	138
10	10	DMC1010	7.00	7.00	0.40	0.40	145
12	4	DMC124	4.00	8.75	0.42	0.34	100
12	6	DMC126	5.00	8.75	0.42	0.36	140
12	8	DMC128	6.50	8.75	0.42	0.38	162
12	10	DMC1210	7.50	8.75	0.42	0.40	190
12	12	DMC1212	8.50	8.50	0.42	0.42	213
14	8	DMC148	8.00	10.50	0.47	0.38	259
14	14	DMC1414	10.50	10.50	0.47	0.47	299
16	6	DMC166	6.50	11.50	0.50	0.36	250
16	8	DMC168	7.50	11.50	0.50	0.38	289
16	10	DMC1610	8.50	11.50	0.50	0.40	345
16	12	DMC1612	9.50	11.50	0.50	0.42	397
16	16	DMC1616	11.50	11.50	0.50	0.50	385
20	20	DMC2020	14.00	14.00	0.57	0.57	605
24	24	DMC2424	16.00	16.00	0.61	0.61	830
30	30	DMC3030	22.00	22.00	0.66	0.66	1840
36	36	DMC3636	26.00	26.00	0.74	0.74	2655
42	42	DMC4242	30.00	30.00	0.82	0.82	3725
48	48	DMC4848	33.50	33.50	0.90	0.90	4955



## Tees

SIZE		MJ x MJ						MJ x Flange			
Run	Br.	Item No.	Wt.	H	J	T	T1	Item No.	Wt.	H	L
2	2	DMT22	16	3.00	3.00	0.30	0.30				
3	3	DMT33	28	3.00	3.00	0.33	0.33	DMF33	28	3.00	5.50
4	2	DMT42	29	3.00	4.00	0.34	0.30				
4	3	DMT43	30	3.50	4.00	0.34	0.33				
4	4	DMT44	32	4.00	4.00	0.34	0.34	DMF44	38	4.00	6.50
6	3	DMT63	42	3.50	5.00	0.36	0.33	DMF63	51	3.50	8.00
6	4	DMT64	46	4.00	5.00	0.36	0.34	DMF64	54	4.00	8.00
6	6	DMT66	56	5.00	5.00	0.36	0.36	DMF66	56	5.00	8.00
8	3	DMT83	52	3.50	6.50	0.38	0.33	DMF83	70	4.00	9.00
8	4	DMT84	60	4.00	6.50	0.38	0.34	DMF84	72	4.00	9.00
8	6	DMT86	72	5.00	6.50	0.38	0.36	DMF86	83	5.00	9.00
8	8	DMT88	86	6.50	6.50	0.38	0.38	DMF88	94	6.50	9.00
10	3	DMT103	75	4.00	7.50	0.40	0.33				
10	4	DMT104	78	4.00	7.50	0.40	0.34	DMF104	89	4.00	11.00
10	6	DMT106	90	5.00	7.50	0.40	0.36	DMF106	107	5.00	11.00
10	8	DMT108	105	6.50	7.50	0.40	0.38	DMF108	115	6.50	11.00
10	10	DMT1010	120	7.50	7.50	0.40	0.40	DMF1010	130	7.50	11.00
12	3	DMT123	90	4.00	8.75	0.42	0.33				
12	4	DMT124	94	4.00	8.75	0.42	0.34	DMF124	115	4.00	12.00
12	6	DMT126	110	5.00	8.75	0.42	0.36	DMF126	120	5.00	12.00
12	8	DMT128	125	6.50	8.75	0.42	0.38	DMF128	146	6.50	12.00





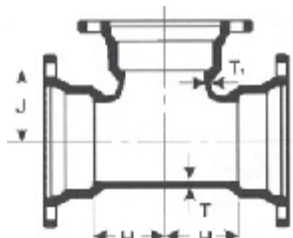
# SIGMA

Weights in Pounds, Less Accessories / Dimensions in inches  
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

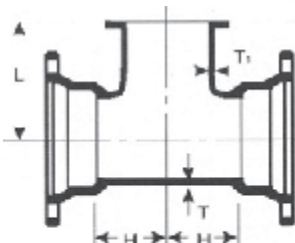
## C153 Mechanical Joint Compact Fittings

Tees (continued)

SIZE		MJ x MJ						MJ x Flange			
Run	Br.	Item No.	Wt.	H	J	T	T1	Item No.	Wt.	H	L
12	10	DMT1210	140	7.50	8.75	0.42	0.40	DMF1210	174	7.50	12.00
12	12	DMT1212	160	8.75	8.75	0.42	0.42	DMF1212	198	8.75	12.00
14	4	DMT144	172	5.50	10.50	0.47	0.34				
14	6	DMT146	182	6.50	10.50	0.47	0.36				
14	8	DMT148	206	7.50	10.50	0.47	0.38				
14	10	DMT1410	228	8.50	10.50	0.47	0.40				
14	12	DMT1412	234	9.50	10.50	0.47	0.42				
14	14	DMT1414	280	10.50	10.50	0.47	0.47				
16	6	DMT166	228	6.50	11.50	0.50	0.36	DMF166	213	6.50	15.00
16	8	DMT168	248	7.50	11.50	0.50	0.38	DMF168	260	7.50	15.00
16	10	DMT1610	264	8.50	11.50	0.50	0.40	DMF1610	287	8.50	15.00
16	12	DMT1612	280	9.50	11.50	0.50	0.42	DMF1612	312	9.50	15.00
16	14	DMT1614	316	10.50	11.50	0.50	0.47				
16	16	DMT1616	322	11.50	11.50	0.50	0.50				
18	6	DMT186	275	6.50	12.50	0.54	0.36	DMF186	261	6.50	15.50
18	8	DMT188	295	7.50	12.50	0.54	0.38				
18	10	DMT1810	315	8.50	12.50	0.54	0.40				
18	12	DMT1812	335	9.50	12.50	0.54	0.42				
18	14	DMT1814	380	10.50	12.50	0.54	0.47				
18	16	DMT1816	428	11.50	12.50	0.54	0.50				
18	18	DMT1818	448	12.50	12.50	0.54	0.54				
20	6	DMT206	348	6.50	14.00	0.57	0.36	DMF206	345	6.50	17.00
20	8	DMT208	345	8.00	14.00	0.57	0.38	DMF208	384	8.00	17.00
20	10	DMT2010	370	9.00	14.00	0.57	0.40				
20	12	DMT2012	441	10.00	14.00	0.57	0.42				
20	14	DMT2014	440	11.00	14.00	0.57	0.47				
20	16	DMT2016	465	12.00	14.00	0.57	0.50				
20	18	DMT2018	505	13.00	14.00	0.57	0.54				
20	20	DMT2020	535	14.00	14.00	0.57	0.57				
24	6	DMT246	415	7.00	16.00	0.61	0.36	DMF246	460	7.00	19.00
24	8	DMT248	445	8.00	16.00	0.61	0.38	DMF248	418	8.00	19.00
24	10	DMT2410	470	9.00	16.00	0.61	0.40				
24	12	DMT2412	500	10.00	16.00	0.61	0.42				
24	14	DMT2414	550	11.00	16.00	0.61	0.47				
24	16	DMT2416	580	12.00	16.00	0.61	0.50				
24	18	DMT2418	630	13.00	16.00	0.61	0.54				
24	20	DMT2420	660	14.00	16.00	0.61	0.57				
24	24	DMT2424	720	16.00	16.00	0.61	0.61				
30	6	DMT306	700	7.00	20.00	0.66	0.36				
30	8	DMT308	739	8.50	20.00	0.66	0.38				
30	12	DMT3012	830	10.00	20.00	0.66	0.42				
30	16	DMT3016	959	12.50	20.00	0.66	0.50				
30	20	DMT3020	995	15.00	20.00	0.66	0.57				
30	24	DMT3024	1060	16.00	20.00	0.66	0.61				
30	30	DMT3030	1323	20.00	20.00	0.66	0.66				
36	12	DMT3612	1205	10.00	23.50	0.74	0.43				
36	16	DMT3616	1350	12.50	23.50	0.74	0.52				
36	24	DMT3624	1498	16.00	23.50	0.74	0.61				
36	30	DMT3630	1767	20.00	23.50	0.74	0.66				
36	36	DMT3636	1900	23.50	23.50	0.74	0.74				
42	12	DMT4212	1410	10.00	29.50	0.82	0.43				
42	24	DMT4224	2270	20.00	27.50	0.82	0.61				
42	30	DMT4230	2425	22.00	29.50	0.82	0.66				
42	36	DMT4236	3000	30.00	30.00	0.82	0.74				
42	42	DMT4242	3175	30.00	30.00	0.82	0.82				
48	24	DMT4824	2870	23.00	32.00	0.90	0.61				
48	30	DMT4830	3050	23.00	32.00	0.90	0.66				
48	36	DMT4836	3900	33.50	32.25	0.90	0.74				
48	42	DMT4842	4100	33.50	33.50	0.90	0.82				
48	48	DMT4848	4250	33.50	33.50	0.90	0.90				



MJ x MJ  
DMT

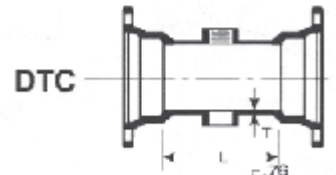
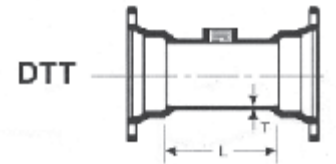


MJ x FLANGE  
DMF

# C153 Mechanical Joint Compact Fittings

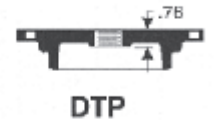
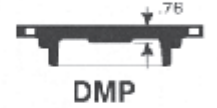
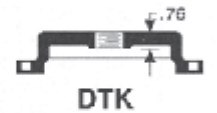
## Tapped Tees and Crosses

Size	TEE		CROSS		T	L	Tap Size
	Item No.	Wt.	Item No.	Wt.			
3	DTT3	35	DTC3	19	0.33	6.0	2
4	DTT4	45	DTC4	23	0.34	8.0	2
6	DTT6	70	DTC6	37	0.36	10.0	2
8	DTT8	95	DTC8	53	0.38	13.0	2
10	DTT10	130	DTC10	68	0.40	14.0	2
12	DTT12	165	DTC12	88	0.42	17.5	2
16	DTT16	178	DTC16	178	0.50	23.0	2
20	DTT20	259	DTC20	259	0.57	28.0	2
24	DTT24	320	DTC24	320	0.61	32.0	2



## Caps and Plugs

Size	CAP SOLID	CAP TAPPED	Wt.	PLUG SOLID	PLUG TAPPED	Wt.
	Item No.	Item No.		Item No.	Item No.	
3	DMK3	DTK3	8	DMP3	DTP3	8
4	DMK4	DTK4	9	DMP4	DTP4	10
6	DMK6	DTK6	15	DMP6	DTP6	16
8	DMK8	DTK8	22	DMP8	DTP8	26
10	DMK10	DTK10	32	DMP10	DTP10	36
12	DMK12	DTK12	42	DMP12	DTP12	46
14	DMK14	DTK14	66	DMP14	DTP14	75
16	DMK16	DTK16	92	DMP16	DTP16	95
18	DMK18	DTK18	114	DMP18	DTP18	121
20	DMK20	DTK20	125	DMP20	DTP20	135
24	DMK24	DTK24	166	DMP24	DTP24	175
30	DMK30	DTK30	345	DMP30	DTP30	355
36	DMK36	DTK36	628	DMP36	DTP36	688



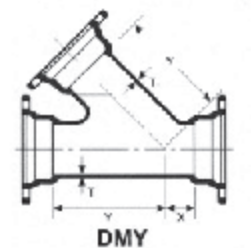
## Push In Plugs

Size	SOLID PLUG	TAPPED PLUG	Wt.	T
	Item No.	Item No.		
4	DPP4	PTP4	12	0.43
6	DPP6	PTP6	20	0.47
8	DPP8	PTP8	27	0.49
10	DPP10	PTP10	36	0.52
12	DPP12	PTP12	47	0.54
16	DPP16	PTP16	59	0.60



## Wyes (45 degree laterals)

Size	Run	Branch	Item No.	X	Y	T	T1	Wt.
4	4	DMY44	2.5	9.5	.35	.35	45	
6	4	DMY64	1.5	11.0	.37	.35	67	
6	6	DMY66	3.0	13.0	.37	.37	93	
8	4	DMY84	0.5	13.0	.39	.35	93	
8	6	DMY86	2.0	14.5	.39	.37	113	
8	8	DMY88	3.5	16.0	.39	.39	136	
10	4	DMY104	0.0	15.0	.41	.35	118	
10	6	DMY106	1.0	16.0	.41	.37	136	
10	8	DMY108	2.5	17.0	.41	.39	170	
10	10	DMY1010	3.5	19.0	.41	.41	199	
12	4	DMY124	0.0	16.5	.43	.35	150	
12	6	DMY126	1.5	18.5	.43	.37	186	
12	8	DMY128	1.5	18.5	.43	.39	188	
12	10	DMY1210	3.0	20.0	.43	.41	223	
12	12	DMY1212	4.5	22.5	.43	.43	272	

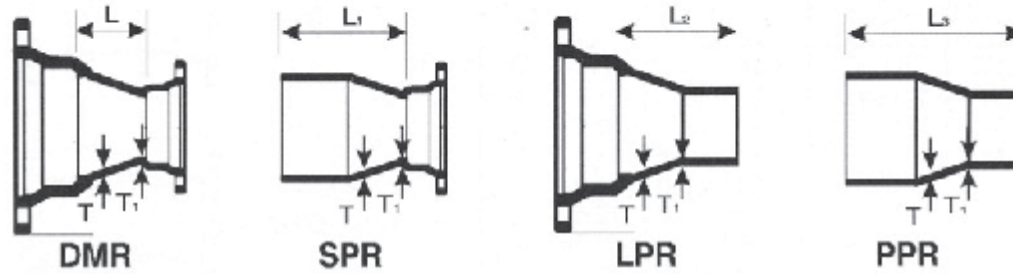




# SIGMA

Weights in Pounds, Less Accessories / Dimensions in inches  
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

## C153 Mechanical Joint Compact Fittings



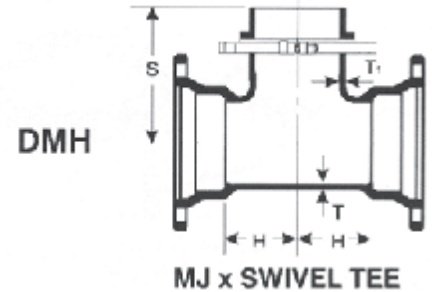
### Reducers

Size	Item No.	Wt.	L	Item No.	Wt.	L1	Item No.	Wt.	L2	Item No.	Wt.	L3	T	T1
4 x 2	DMR42	16	2.50	SPR42	14	8.00							0.34	0.30
4 x 3	DMR43	18	3.00	SPR43	17	8.50	LPR43	18	8.50	PPR43	14	14.00	0.34	0.33
6 x 3	DMR63	22	5.00	SPR63	24	10.50	LPR63	19	10.50	PPR63	19	16.00	0.36	0.33
6 x 4	DMR64	24	4.00	SPR64	25	9.50	LPR64	25	9.50	PPR64	22	15.00	0.36	0.34
8 x 4	DMR84	32	5.00	SPR84	30	10.50	LPR84	34	10.50	PPR84	30	16.00	0.38	0.34
8 x 6	DMR86	36	4.00	SPR86	35	9.50	LPR86	32	9.50	PPR86	30	15.00	0.38	0.36
10 x 4	DMR104	46	7.00	SPR104	43	12.50	LPR104	43	12.50	PPR104	46	18.00	0.40	0.34
10 x 6	DMR106	47	5.00	SPR106	46	10.50	LPR106	42	10.50	PPR106	46	16.00	0.40	0.36
10 x 8	DMR108	50	4.00	SPR108	42	9.50	LPR108	50	9.50	PPR108	49	15.00	0.40	0.38
12 x 4	DMR124	58	9.00	SPR124	60	14.50	LPR124	60	14.50	PPR124	58	20.00	0.42	0.34
12 x 6	DMR126	58	7.00	SPR126	58	12.50	LPR126	58	12.50	PPR126	58	18.00	0.42	0.36
12 x 8	DMR128	57	5.00	SPR128	54	10.50	LPR128	55	10.50	PPR128	59	16.00	0.42	0.38
12 x 10	DMR1210	61	4.00	SPR1210	59	9.50	LPR1210	59	9.50	PPR1210	59	15.00	0.42	0.40
14 x 6	DMR146	100	9.00	SPR146	100	16.90	LPR146	104	14.50	PPR146	93	22.30	0.47	0.36
14 x 8	DMR148	100	7.00	SPR148	98	14.90	LPR148	98	12.40	PPR148	94	20.30	0.47	0.38
14 x 10	DMR1410	100	5.00	SPR1410	94	12.90	LPR1410	92	10.40	PPR1410	90	18.30	0.47	0.40
14 x 12	DMR1412	100	4.00	SPR1412	90	11.90	LPR1412	92	9.40	PPR1412	88	17.30	0.47	0.42
16 x 6	DMR166	124	11.00	SPR166	125	18.90	LPR166	136	16.50	PPR166	93	24.30	0.50	0.36
16 x 8	DMR168	124	9.00	SPR168	121	16.90	LPR168	128	14.40	PPR168	121	22.30	0.50	0.38
16 x 10	DMR1610	124	7.00	SPR1610	105	15.00	LPR1610	123	12.50	PPR1610	119	20.50	0.50	0.40
16 x 12	DMR1612	112	5.00	SPR1612	109	12.90	LPR1612	108	10.50	PPR1612	99	18.30	0.50	0.42
16 x 14	DMR1614	140	4.00	SPR1614	126	12.00	LPR1614	132	12.00	PPR1614	129	19.70	0.50	0.47
18 x 6	DMR186	194	16.00										0.54	0.36
18 x 8	DMR188	190	13.00	SPR188	170	20.00	LPR188	195	19.50	PPR188	170	27.40	0.54	0.38
18 x 10	DMR1810	195	10.00	SPR1810	165	18.00	LPR1810	185	17.40	PPR1810	160	25.50	0.54	0.40
18 x 12	DMR1812	180	7.00	SPR1812	150	15.50	LPR1812	175	14.00	PPR1812	150	19.50	0.54	0.42
18 x 14	DMR1814	190	6.00	SPR1814	175	15.00	LPR1814	190	15.00	PPR1814	160	23.00	0.54	0.47
18 x 16	DMR1816	193	5.00	SPR1816	170	12.50	LPR1816	190	12.50	PPR1816	145	18.00	0.54	0.50
20 x 6	DMR206	232	22.00	SPR206	201	30.00	LPR206	231	27.50	PPR206	106	35.50	0.57	0.36
20 x 8	DMR208	227	19.00	SPR208	198	27.00	LPR208	227	24.50	PPR208	106	32.50	0.57	0.38
20 x 10	DMR2010	230	14.00	SPR2010	200	22.00	LPR2010	210	19.00	PPR2010	180	27.50	0.57	0.40
20 x 12	DMR2012	205	12.00	SPR2012	170	17.50	LPR2012	205	16.00	PPR2012	190	21.50	0.57	0.42
20 x 14	DMR2014	200	10.00	SPR2014	190	18.00	LPR2014	205	17.90	PPR2014	195	26.00	0.57	0.47
20 x 16	DMR2016	200	7.00	SPR2016	185	13.50	LPR2016	200	13.50	PPR2016	170	19.00	0.57	0.50
20 x 18	DMR2018	225	4.00	SPR2018	200	12.00	LPR2018	225	12.00	PPR2018	190	20.00	0.57	0.54
24 x 6	DMR246	322	28.00	SPR246	284	36.00	LPR246	320	33.50	PPR246	283	41.50	0.61	0.36
24 x 8	DMR248	318	25.00	SPR248	282	33.00	LPR248	316	30.50	PPR248	281	38.50	0.61	0.38
24 x 10	DMR2410	312	22.00	SPR2410	276	30.00	LPR2410	310	27.50	PPR2410	274	35.50	0.61	0.40
24 x 12	DMR2412	305	16.00	SPR2412	275	21.50	LPR2412	290	21.00	PPR2412	240	22.50	0.61	0.42
24 x 14	DMR2414	310	14.00	SPR2414	310	22.00	LPR2414	315	21.90	PPR2414	295	25.00	0.61	0.47
24 x 16	DMR2416	320	12.00	SPR2416	285	17.50	LPR2416	285	17.50	PPR2416	285	23.00	0.61	0.50
24 x 18	DMR2418	308	10.00	SPR2418	300	18.00	LPR2418	310	18.00	PPR2418	290	21.00	0.61	0.54
24 x 20	DMR2420	300	7.00	SPR2420	270	13.50	LPR2420	275	13.50	PPR2420	240	14.00	0.61	0.57
30 x 16	DMR3016	633	30.00	SPR3016	565	39.00	LPR3016	623	39.00	PPR3016	555	48.00	0.66	0.50
30 x 18	DMR3018	658	28.00	SPR3018	590	37.00	LPR3018	635	37.00	PPR3018	567	46.00	0.66	0.54
30 x 20	DMR3020	628	24.00	SPR3020	560	33.00	LPR3020	603	33.00	PPR3020	535	42.00	0.60	0.57
30 x 24	DMR3024	478	10.00	SPR3024	495	24.50	LPR3024	526	24.50	PPR3024	458	33.50	0.66	0.61
36 x 20	DMR3620	975	36.00	SPR3620	874	45.00	LPR3620	950	45.00	PPR3620	849	54.00	0.74	0.57
36 x 24	DMR3624	770	19.00	SPR3624	746	33.00	LPR3624	810	33.00	PPR3624	709	42.00	0.74	0.61
36 x 30	DMR3630	650	15.50	SPR3630	725	24.50	LPR3630	758	24.50	PPR3630	657	33.50	0.74	0.66
42 x 24	DMR4224	1356	40.00	SPR4224	1204	49.00	LPR4224	1319	49.00	PPR4224	1167	58.00	0.82	0.61
42 x 30	DMR4230	1083	20.00	SPR4230	931	29.00	LPR4230	1015	29.00	PPR4230	863	38.00	0.82	0.66
42 x 36	DMR4236	1114	15.50	SPR4236	962	24.50	LPR4236	1013	24.50	PPR4236	861	33.50	0.82	0.74
48 x 30	DMR4830	1779	40.00	SPR4830	1594	49.00	LPR4830	1711	49.00	PPR4830	1526	58.00	0.90	0.66
48 x 36	DMR4836	1641	28.00	SPR4836	1456	37.00	LPR4836	1540	37.00	PPR4836	1355	46.00	0.90	0.74
48 x 42	DMR4842	1426	15.50	SPR4842	1241	24.50	LPR4842	1274	24.50	PPR4842	1089	33.50	0.90	0.82

# C153 Mechanical Joint Compact Fittings

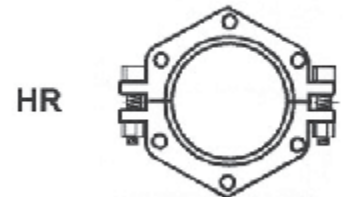
## Tees: MJ x Swivel (Hydrant Tees)

Size	Item No.	H	S	T	T1	Wt
6 x 6	DMH66	5.00	10.00	0.36	0.36	77
8 x 6	DMH86	5.00	11.00	0.38	0.36	89
8 x 8	DMH88	6.50	11.00	0.38	0.38	116
10 x 6	DMH106	5.00	12.50	0.40	0.36	113
10 x 8	DMH108	6.50	12.50	0.40	0.38	129
12 x 6	DMH126	5.00	13.50	0.42	0.36	128
12 x 8	DMH128	6.50	13.50	0.42	0.38	149
14 x 6	DMH146	6.50	15.00	0.47	0.36	211
16 x 6	DMH166	6.50	16.00	0.50	0.36	248
16 x 8	DMH168	7.50	16.00	0.50	0.38	298
18 x 6	DMH186	6.50	17.00	0.54	0.36	300
20 x 6	DMH206	6.50	18.50	0.57	0.36	358
20 x 8	DMH208	8.00	18.50	0.57	0.38	382
24 x 6	DMH246	7.00	19.00	0.61	0.36	458
24 x 8	DMH248	8.00	19.00	0.61	0.38	477



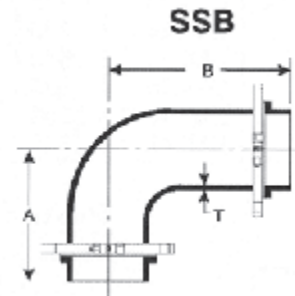
## Swivel Gland

Size	Item No.	Wt.
4	HR4	8
6	HR6	18
8	HR8	15
10	HR10	18
12	HR12	24



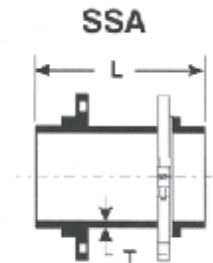
## Swivel x Solid 90 Degree Bend

Size	Item No.	A	B	T	Wt.
6	SSB690	10.50	16.00	.36	52
8	SSB890	12.50	18.00	.38	74
10	SSB1090	13.00	20.00	.40	102



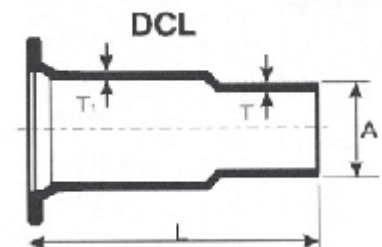
## Swivel x Solid Adapter

Size	Item No.	L	T	Wt.
4	SSA413	13.00	0.34	29
6	SSA613	13.00	0.36	47
6	SSA618	18.00	0.36	58
6	SSA624	24.00	0.36	69
6	SSA630	30.00	0.36	66
6	SSA636	36.00	0.36	75
6	SSA648	48.00	0.36	94
6	SSA660	60.00	0.36	112
6	SSA672	72.00	0.36	131
8	SSA813	13.00	0.38	52
10	SSA1013	13.00	0.40	69
12	SSA1213	13.00	0.42	87



## Dual Cutting-In Sleeves

Size	Item No.	Wt.	T	T1	A	L
3	DCL3	34	0.34	0.36	3.96	20
4	DCL4	50	0.35	0.37	4.80	20
6	DCL6	62	0.37	0.39	6.90	20
8	DCL8	90	0.39	0.41	9.05	20
10	DCL10	105	0.41	0.43	11.10	20
12	DCL12	128	0.43	0.45	13.20	20

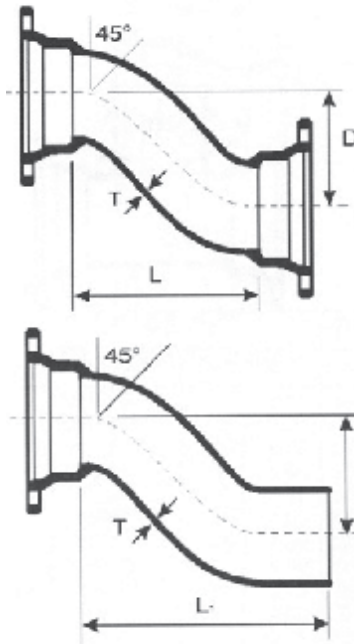




# SIGMA C153 Mechanical Joint Compact Fittings

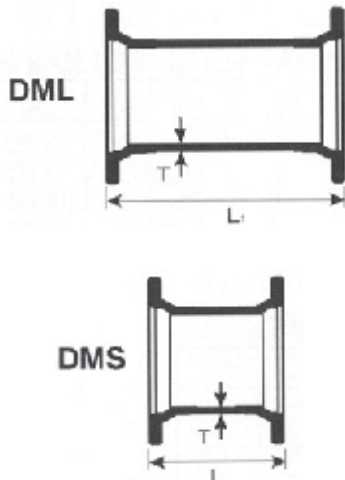
Weights in Pounds, Less Accessories / Dimensions in inches  
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

## Offsets

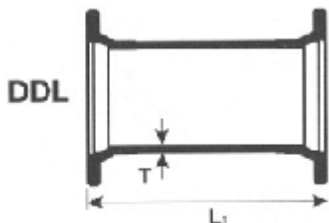


MJ x MJ Size	Item No.	Wt.	D	L	L1	T	MJ x PE Item No.	Wt.
3 x 6	DMO36	30	6.00	9.00	14.50	0.33	DMQ36	29
3 x 12	DMO312	40	12.00	15.00	20.50	0.33	DMQ312	39
3 x 18	DMO318	49	18.00	21.00	26.50	0.33	DMQ318	48
3 x 24	DMO324	55	24.00	27.00	32.50	0.33	DMQ324	53
4 x 6	DMO46	45	6.00	10.00	15.50	0.34	DMQ46	44
4 x 12	DMO412	55	12.00	16.00	21.50	0.34	DMQ412	54
4 x 18	DMO418	65	18.00	22.00	27.50	0.34	DMQ418	63
4 x 24	DMO424	75	24.00	28.00	33.50	0.34	DMQ424	72
6 x 6	DMO66	41	6.00	12.00	17.50	0.36	DMQ66	54
6 x 12	DMO612	65	12.00	18.00	23.50	0.36	DMQ612	64
6 x 18	DMO618	75	18.00	24.00	29.50	0.36	DMQ618	72
6 x 24	DMO624	85	24.00	30.00	35.50	0.36	DMQ624	82
8 x 6	DMO86	84	6.00	13.00	18.50	0.38	DMQ86	78
8 x 12	DMO812	90	12.00	19.00	24.50	0.38	DMQ812	88
8 x 18	DMO818	100	18.00	25.00	30.50	0.38	DMQ818	96
10 x 6	DMO106	105	6.00	15.00	20.50	0.40	DMQ106	102
10 x 12	DMO1012	135	12.00	21.00	26.50	0.40	DMQ1012	132
10 x 18	DMO1018	165	18.00	27.00	32.50	0.40	DMQ1018	160
12 x 6	DMO126	124	6.00	17.00	22.50	0.42	DMQ126	112
12 x 12	DMO1212	153	12.00	23.00	28.50	0.42	DMQ1212	146
12 x 18	DMO1218	190	18.00	29.00	34.50	0.42	DMQ1218	184
12 x 24	DMO1224	202	24.00	35.00	40.50	0.42	DMQ1224	194
12 x 30	DMO1230	213	30.00	41.00	46.50	0.42	DMQ1230	205

## Sleeves



Size	Item No.	Wt.	L	Item No.	Wt.	L1	T
3	DMS3	13	7.50	DML3	18	12.00	0.33
4	DMS4	17	7.50	DML4	20	12.00	0.34
6	DMS6	28	7.50	DML6	33	12.00	0.36
8	DMS8	38	7.50	DML8	46	12.00	0.38
10	DMS10	49	7.50	DML10	62	12.00	0.40
12	DMS12	56	7.50	DML12	76	12.00	0.42
14	DMS14	111	9.50	DML14	140	15.00	0.47
16	DMS16	123	9.50	DML16	170	15.00	0.50
18	DMS18	160	9.00	DML18	200	15.00	0.54
20	DMS20	195	9.00	DML20	255	15.00	0.57
24	DMS24	255	9.00	DML24	335	15.00	0.61
30	DMS30	500	15.00	DML30	640	24.00	0.66
36				DML36	925	24.00	0.74
42				DML42	1150	24.00	0.82
48				DML48	1435	24.00	0.90

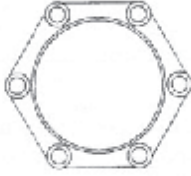


## Dual Purpose Sleeves

Item No.	L1	T	Wt.
DDL3	23	12	0.33
DDL4	32	12	0.34
DDL6	50	12	0.36
DDL8	65	12	0.38
DDL10	89	12	0.40
DDL12	104	12	0.42

# C153 Mechanical Joint Compact Fittings

## Mechanical Joint Accessories



**MJ Glands**

Size	Item No.	Wt.
2	DG2	2
3	DG3	4
4	DG4	5
6	DG6	6
8	DG8	7
10	DG10	10
12	DG12	15
14	DG14	23
16	DG16	28
18	DG18	30
20	DG20	43
24	DG24	50
30	DG30	85
36	DG36	115
42	DG42	180
48	DG48	275



**MJ Gaskets**

Size	Item No.	Wt.	Item No.	Wt.
2	MG2			
3	MG3	0.25	TG3	0.50
4	MG4	0.30	TG4	0.60
6	MG6	0.50	TG6	0.75
8	MG8	0.75	TG8	1.10
10	MG10	0.80	TG10	1.30
12	MG12	1.00	TG12	1.65
14	MG14	1.30		
16	MG16	1.45		
18	MG18	1.60		
20	MG20	1.90		
24	MG24	2.10		
30	MG30	2.30		
36	MG36	2.75		
42	MG42	3.20		
48	MG48	3.65		

### Gasket/Bolt Packs

Size (in.)	Item No.	Wt. (lb.)
3	MGP3	3
4	MGP4	4
6	MGP6	6
8	MGP8	7
10	MGP10	8
12	MGP12	9

### MJ Gland Packs

Size (in.)	Item No.	Wt. (lb.)
2	DGP2	6
3	DGP3	7
4	DGP4	8
6	DGP6	12
8	DGP8	15
10	DGP10	20
12	DGP12	25
14	DGP14	37
16	DGP16	43
18	DGP18	47
20	DGP20	61
24	DGP24	72

### Low Alloy, Corrosion Resistant Steel T-Head Bolts Standard Bolts

Size (in.)	Item No.	Wt. (lb.)
3	MGP3	3
4	MGP4	4
6	MGP6	6
8	MGP8	7
10	MGP10	8
12	MGP12	9

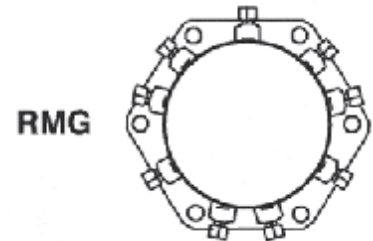
### Anti-Rotation Bolts

Size (in.)	Item No.	Wt. (lb.)
3	MGP3	3
4	MGP4	4
6	MGP6	6
8	MGP8	7
10	MGP10	8
12	MGP12	9

Includes: Gland, MJ Gasket, and Standard Tee Bolts & Nuts

### MJ Retainer Glands

Pipe Size	Item No.	Wt.	IRON PIPE O.D	Rating (psi)	Qty	Size	Torque (ft-lbs)
3	RMG3	5	3.96	350	4	5/8 X 2	85
4	RMG4	7	4.80	350	4	5/8 X 2	85
6	RMG6	12	6.90	350	6	5/8 X 2	85
8	RMG8	16	9.05	250	9	5/8 X 2	85
10	RMG10	22	11.10	250	16	5/8 X 2	85
12	RMG12	28	13.20	250	16	5/8 X 2	85
14	RMG14	45	15.30	250	20	5/8 X 2	85
16	RMG16	52	17.40	250	24	5/8 X 2	85
18	RMG18	62	19.50	200	24	5/8 X 2	85
20	RMG20	75	21.60	200	28	3/4 X	110
24	RMG24	97	25.80	200	32	3 3/4 X	110
30	RMG30	196	32.00	100	40	3 3/4 X 3	110
36	RMG36	246	38.30	100	48	3/4 X 2-1/2	110
42	RMG42	302	44.50	100	56	3/4 X 2-1/2	110
48	RMG48	380	50.80	100	64	3/4 X 2-1/2	110



### Retainer Packs

Size	Item No.	Wt.
3	RGP3	9
4	RGP4	10
6	RGP6	15
8	RGP8	19
10	RGP10	25
12	RGP12	32



## The Total SIGMA Line Card

**Mechanical Joint Fittings\***

- Compact, DI, 2"–48" (AWWA C153)
- Full Body, DI, 3"–48" (AWWA C110)

**Push-On Fittings\***

- Compact DI, 4"–24" (AWWA C153), TYTON® Joint
- Full Body, CI/DI, 4"–24" (AWWA C110)

**Flanged Fittings**

- DI Fittings 2" – 54" (AWWA C110)
- CI Fittings 3" – 12" (AWWA C110)

\*Sizes 3-24 Available with AWWA C116 Fusion Bonded Epoxy  
All Fittings Products sizes 4-48" available with PROTECTO 401® Ceramic Epoxy Lining for wastewater applications

**PV-LOK™ (Serration Type Restraints)**

PVM Series: Pipe to MJ Bells

- 4" – 48" Restraints for PVC Pipe with DI Pipe OD
- 2" – 12" Restraints for PVC Pipe with Steel Pipe OD

PVP\* Series: Spigot PVC Pipe to PVC Pipe Bells

- 4" – 48" Restraints for PVC with DI Pipe OD
- 2" – 12" Restraints for PVC Pipe with Steel Pipe OD

PVPF Series: Pipe to PVC Pressure Fittings

- 4" – 48" Restraints for PVC Pipe with DI Pipe OD
- 4" – 8" Restraints for PVC with Steel Pipe OD

\*Also for use with DI pipe in 4" – 16" range

**Mechanical Joint Accessories**

- Gland Packs
- Valve Packs
- Bolt Packs
- T Bolts & nuts
- BLUE T Bolts & Nuts

**Retainer Glands with Set Screws 3" – 48"**

**Flange Adapters (ZIP FLANGE®): 4" – 48"**

**OMNI-SLEEVE™ (all-in-one patented wall sleeve)**

**Threaded Flanges & Flange Adapters**

- 3" – 54" (for DI Pipe Fabrication)
- Drilled and Tapped Flanges
- 250 lb Drilled Flanges
- Anchor Flanges
- MJ Bell Adapters – Threaded Bell + PE Adapter

**ONE-LOK™ (Wedge-Action Type Restraints)**

SLD Series: DI Pipe to MJ Bells

- 3" – 48" Restraints for DI Pipe
- 4" – 12" 20" Available for Large Size CI Pipe OD (SLDM)
- 4" – 12" Split Restraints (SSLD)
- 4" – 24" Harness Restraint for DI pipe joints (SLDH)

SLC Series: PVC Pipe to MJ Bells

- 4" – 36" Restraints for PVC Pipe with DI Pipe OD
- 4" – 12" Restraints for PVC Pipe with Steel Pipe OD

\*3" – 24" restraints are available in loose or packaged with MJ gasket and T-head bolts & nuts. 30" – 48" available as a package only.

**Municipal Construction Castings**

- Valve Boxes & Service Boxes, risers and extensions
- Service Boxes & Curb Boxes
- Meter Boxes & Lids
- Manhole Covers, Grates, & Frames, Risers Rings
- Ornamental & Architectural Castings

**Extended Products**

- Tie-Rod Accessories
  - Duc lugs
  - Threaded Rods
  - Eye Bolts
  - Pipe Hangers and Clamps
- Flange Accessory Kits
  - Pipe Lubricant
  - Hydraulic Cement
  - Tracer Wire
  - Detectable Tape

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Pennsylvania	Oklahoma		Oregon, Wyoming	Ohio
	Iowa		Montana	Kentucky
	Puerto Rico		Western Canada	West Virginia

## N-12<sup>®</sup> WT IB PIPE (PER AASHTO)

It's a revolution that began nearly 15 years ago when ADS pioneered the watertight joint for corrugated polyethylene pipe. The ADS N-12 WT IB pipe (per AASHTO) – our third generation of watertight joint technology – has set the standard in watertight performance.

Today's N-12 WT IB pipe (per AASHTO) incorporates patented technology developed in the aerospace industry. A 2" wide proprietary polymer composite is fused to the outside wall of the integral bell, improving the joint's integrity and tolerance control. A patented gasket, that meets all requirements of ASTM F477, increases its sealing forces as intermittent internal or external hydrostatic pressure occurs. Flared bell and spigot significantly improve ease of installation. N-12 WT IB pipe (per AASHTO) is so advanced in its design that it is easy to put your confidence in for long-term reliability.

### APPLICATIONS:

Storm Sewers	Culverts & Cross Drains
Sanitary Sewers	Slope/Edge Drains
Retention/Detention	Mining/Forestry/Industrial
Roof Drainage	Ditch Enclosures

### FEATURES:

- 4" – 60" (100 - 1500 mm) diameters available
- Nominal 20 ft. (6m) and 13 ft. (4m) lengths available
- Integral bell and factory-installed gasket
- Joint meets or exceeds ASTM D3212 lab test as well as ASTM F2487 and ASTM F1417 watertight field test
- Exceptional joint strength
- Excellent abrasion and corrosion resistance
- Light weight
- Structural strength that will support H-25 or HL-93 live loads with 1' (0.3 m) minimum cover; 60" (1500 mm) pipe requires 2' (0.6 m) cover for H-25 or HL-93 loads



### BENEFITS:

- Variety of diameters and lengths fit any project
- Pipe requires no extra couplers, grout or other sealants for installation due to built-in bell and factory-installed gasket. This means fewer components to risk performance.
- Installation cost savings from lower shipping costs, fewer people, and less heavy equipment required.
- Hydraulic efficiency from smooth interior
- Long-term durability of HDPE

**ADS Service:** ADS representatives are committed to providing you with the answers to all your questions, including specifications, and installation and more.



## ADS N-12® WT IB PIPE (PER AASHTO) SPECIFICATION

### SCOPE

This specification describes 4- through 60-inch (100 to 1500 mm) ADS N-12 WT IB pipe (per AASHTO) for use in gravity flow drainage applications.

### PIPE REQUIREMENTS

N-12 WT IB pipe (per AASHTO) shall have a smooth interior and annular exterior corrugations.

- 4- through 10-inch (100 to 250 mm) shall meet AASHTO M252, Type S.
- 12- through 60-inch (300 to 1500 mm) shall meet AASHTO M294, Type S or ASTM F2306.
- Manning's "n" value for use in design shall be 0.012.

### JOINT PERFORMANCE

4- through 60-inch (100 to 1500 mm) pipe shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

12-through 60-inch (300-1500 mm) diameters shall have a reinforced bell with a bell tolerance device. The bell tolerance device shall be installed by the manufacturer.

### FITTINGS

Fittings shall conform to AASHTO M252, AASHTO M294 or ASTM F2306.. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.

### FIELD PIPE AND JOINT PERFORMANCE

To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field testing any pipe material. Contact the manufacturer for recommended leakage rates.

### MATERIAL PROPERTIES

Virgin material for pipe and fitting production shall be high-density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch (100 to 250 mm) diameters, and 435400C for 12- through 60-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12- through 60-inch (300 to 1500mm) virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306, respectfully.

### INSTALLATION

Installation shall be in accordance with ASTM D2321 and ADS published installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot (0.3 m) and for 54- and 60-inch (1350-1500 mm) diameters, the minimum cover shall be 2 foot (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1, Class 2 (minimum 90% SPD) or Class 3 (minimum 90% SPD) material. Maximum fill heights depend on embedment material and compaction level; please refer to Technical Note 2.02. Contact your local ADS representative or visit our website at [www.ads-pipe.com](http://www.ads-pipe.com) for a copy of the latest installation guidelines.

### PIPE DIMENSIONS

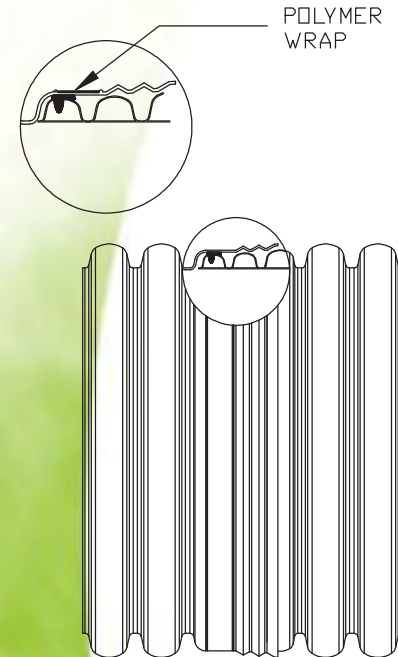
Nominal Pipe I.D.* in. (mm)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)	15 (375)	18 (450)	24 (600)	30 (750)	36 (900)	42 (1050)	48 (1200)	54 (1350)	60 (1500)
Nominal Pipe O.D.** in. (mm)	4.8 (122)	6.9 (175)	9.1 (231)	11.4 (290)	14.5 (368)	18 (457)	22 (559)	28 (711)	36 (914)	42 (1050)	48 (1200)	54 (1350)	61 (1549)	67 (1702)
Perforations	All diameters available with or without perforations.													

\*Check with sales representative for availability by region.

\*\*Pipe O.D. values are provided for reference purposes only, values stated for 12- through 60-inch are ±1 inch. Contact a sales representative for exact values.

ADS "Terms and Conditions of Sale" are available on the ADS website, [www.ads-pipe.com](http://www.ads-pipe.com)

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BRO 10582 09/10 MH





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## SUBMITTAL AND DATA SHEET



PIPE SIZE (IN)	AVERAGE O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	MIN. E (IN)	APPROX. D <sup>9</sup> (IN)	APPROX. WEIGHT (LBS/FT)
<b>Rated 235 psi (DR 18)</b>						
14	15.30	13.50	0.850	8.00	19.00	26.75
16	17.40	15.35	0.967	9.25	21.62	34.86
18	19.50	17.20	1.083	13.00	24.22	48.95
20	21.60	19.06	1.200	14.50	26.85	54.22
24	25.80	22.76	1.433	12.00	32.06	77.97
<b>Rated 200 psi (DR 21)*</b>						
14	15.30	13.75	0.729	8.00	18.22	23.07
16	17.40	15.64	0.829	9.25	20.72	30.04
18	19.50	17.53	0.929	13.00	23.22	37.27
20	21.60	19.42	1.029	14.50	25.72	46.71
24	25.80	23.19	1.229	12.00	30.72	67.53
30	32.00	28.77	1.524	16.75	38.10	103.71
36	38.30	34.43	1.824	19.02	45.60	152.16
<b>Rated 165 psi (DR 25)</b>						
14	15.30	14.00	0.612	8.00	17.94	19.48
16	17.40	15.92	0.696	9.25	20.41	25.38
18	19.50	17.85	0.780	13.00	22.87	31.99
20	21.60	19.77	0.864	14.50	25.34	39.46
24	25.80	23.61	1.032	12.00	30.27	56.98
30	32.00	29.29	1.280	16.75	37.12	88.49
36	38.30	35.05	1.532	19.02	44.43	128.41
42	44.50	40.73	1.780	22.43	51.62	176.02
48*	50.80	46.49	2.032	24.78	58.93	231.22
<b>Rated 125 psi (DR 32.5)*</b>						
14	15.30	14.30	0.471	8.00	17.48	15.14
16	17.40	16.27	0.535	9.25	19.88	19.63
18	19.50	18.23	0.600	13.00	23.30	24.75
20	21.60	20.19	0.665	14.50	24.38	30.54
24	25.80	24.12	0.794	12.00	29.47	44.11
30	32.00	29.91	0.985	16.75	35.94	68.45
36	38.30	35.80	1.178	19.02	43.01	99.22
42	44.50	41.60	1.369	22.43	49.98	135.49
48	50.80	47.49	1.563	24.78	56.73	178.49



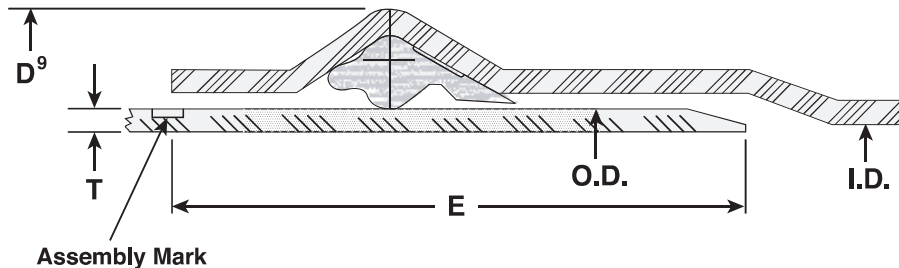
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PIPE SIZE (IN)	AVERAGE O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	MIN. E (IN)	APPROX. D <sup>9</sup> (IN)	APPROX. WEIGHT (LBS/FT)
<b>Rated 100 psi (DR 41)</b>						
14	15.30	14.52	0.37	8.00	16.07	12.01
16	17.40	16.51	0.42	9.25	18.28	15.63
18	19.50	18.50	0.47	13.00	20.49	19.72
20	21.60	20.49	0.52	14.50	22.70	24.31
24	25.80	24.48	0.62	12.00	27.11	35.10
30	32.00	30.35	0.78	16.75	35.12	54.65
36	38.30	36.30	0.93	19.02	42.04	78.97
42	44.50	42.18	1.08	22.43	48.84	108.19
48	50.80	48.14	1.23	24.78	55.76	142.10
<b>Rated 80 psi (DR 51)**</b>						
18	19.50	18.69	0.382	11.09	20.30	15.92
24	25.80	24.72	0.506	14.90	26.86	28.39
30	32.00	30.67	0.627	16.75	34.50	44.08
36	38.30	36.71	0.751	19.02	41.30	64.32
42	44.50	42.65	0.872	22.43	47.99	88.10
48	50.80	48.69	0.996	24.78	54.78	115.79

\* Prior to ordering or specifying, consult JM Eagle™ for product and/or listing availability.

\*\* UL 1285 up to 24"



I.D. : Inside Diameter  
 O.D. : Outside Diameter  
 T. : Wall Thickness  
 D<sup>9</sup> : Bell Outside Diameter  
 E : Distance between Assembly Mark to the end of spigot.

Product Standard: ANSI/AWWA C905  
 Pipe Compound: ASTM D1784 Cells Class 12454  
 Gasket: ASTM F477  
 Integral Bell Joint: ASTM D3139  
 Certifications: ANSI/NSF Standard 61  
 UL Standard 1285 (up to 24")  
 Pipe Length: 20 feet laying length  
 Installation: AWWA C605  
 JM Eagle™ Installation Guide



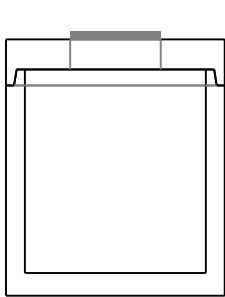
Customer: SUBMITTALS  
 Job Name: CAMILLA  
 State - County - City: GA - - CAMILLA

Structure Name: DI 1  
 Structure Type: Drop Inlet

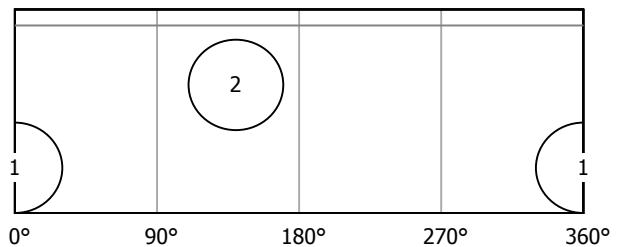
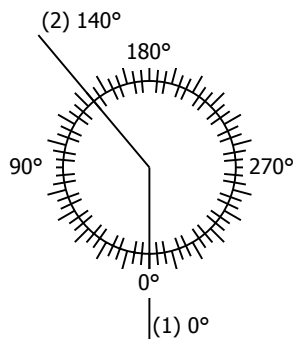
UNDER by 3.75"

Qty	Unit	Description	Height (ft)	Weight (lbs)
1	Each	24"x24" Grate & Frame: 4608-6235 (2X2)	0.188'	215
1	Each	48" Flat Top w/ 2x2 Hole	0.667'	1867
1	Each	48" Base: 4.5'	4.500'	5279
1		24" Hole		
1		24" Hole		
			5.354'	7361

Position	Elevation	Degree	Pipe	Connector
Rim	172.50'			
Invert 1	167.00'	0°	18" HDPE	24" Hole
Invert 2	168.81'	140°	18" HDPE	24" Hole



Elevation View



Expanded Elevation View



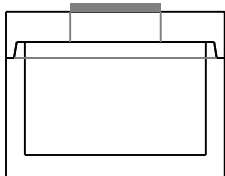
Customer: SUBMITTALS  
 Job Name: CAMILLA  
 State - County - City: GA - - CAMILLA

Structure Name: DI 2  
 Structure Type: Drop Inlet

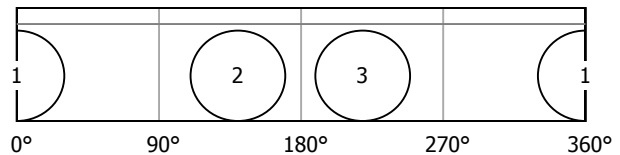
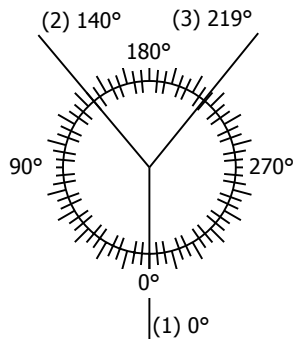
OVER by 0.25"

Qty	Unit	Description	Height (ft)	Weight (lbs)
1	Each	24"x24" Grate & Frame: 4608-6235 (2X2)	0.188'	215
1	Each	48" Flat Top w/ 2x2 Hole	0.667'	1867
1	Each	48" Base: 2.5'	2.500'	3544
1		24" Hole		
1		24" Hole		
1		24" Hole		
			3.354'	5626

Position	Elevation	Degree	Pipe	Connector
Rim	167.73'			
Invert 1	164.55'	0°	18" HDPE	24" Hole
Invert 2	164.55'	140°	18" HDPE	24" Hole
Invert 3	164.55'	219°	18" HDPE	24" Hole



Elevation View



Expanded Elevation View



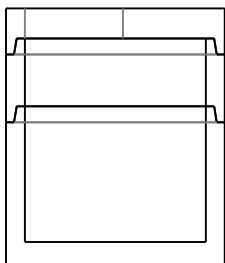
Customer: SUBMITTALS  
 Job Name: CAMILLA  
 State - County - City: GA - - CAMILLA

Structure Name: JB 3  
 Structure Type: Junction Box

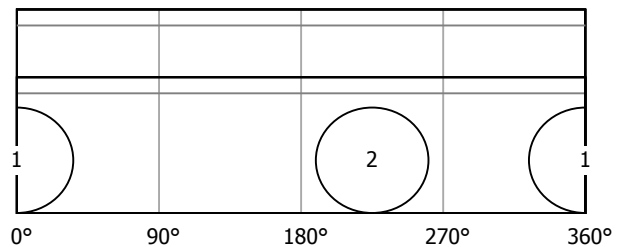
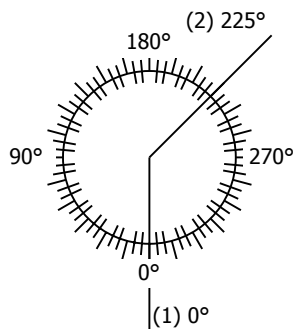
UNDER by 5"

Qty	Unit	Description	Height (ft)	Weight (lbs)
1	Each	26" Ring & Cover: 1259-BD (1033)		130
1	Each	48" Flat Top w/ 26" Hole	0.667'	1867
1	Each	48" Riser: 1.5'	1.500'	1280
1	Each	48" Base: 3'	3.000'	3978
1		28" Hole		
1		28" Hole		
			5.167'	7255

Position	Elevation	Degree	Pipe	Connector
Rim	169.00'			
Invert 1	163.50'	0°	24" Ductile Iron	28" Hole
Invert 2	163.50'	225°	24" Ductile Iron	28" Hole



Elevation View



Expanded Elevation View

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## **Appendix C. Liner Warranty and Installer Contact Information**

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**DX2 GEOSYNTEX, INC.**  
**LIMITED WORKMANSHIP WARRANTY**

Warranty No: 47707-47724

Project No: \_\_\_\_\_

Effective Date: 11/21/14

Purchaser Name: Garrett Consulting Inc.

Address: 417 Overlook Trail

City, State, Zip: Dallas, GA 30132

Project Name: Camilla Wood Preserving

Description: Misc. Liner Repairs

Address: 355 Thomas Street

City, State, Zip: Camilla, GA 31730

DX2 Geosyntex, Inc., (DX2) warrants each LINER SYSTEM installed by DX2 to be free from defects in workmanship. This "Workmanship Warranty" shall be in effect from the date the installation of the LINER SYSTEM is completed and accepted by the Owner for a period of one year of normal use in approved applications.

This Limited Warranty does not include damages or defects in LINER SYSTEM resulting from the acts of God, casualty of catastrophe including but not limited to: earthquakes, floods, piercing hail, tornadoes or force majeure. The term "normal use" as used herein does not include, among other things, the exposure of LINER SYSTEM to harmful chemicals, abuse of LINER SYSTEM by machinery, equipment or people, excessive pressures or stress from any source, subsurface or overburdened soil conditions, and total or differential soil settlements and the effect these may have on the liner system.

Should defects or premature loss of use within the scope of the above Limited Workmanship Warranty occur, DX2 Geosyntex, Inc., will at its option, repair or replace the Liner on a pro-rated basis at the then current price in such manner as to charge the Purchaser/User only for that portion of the warranted life which has elapsed since purchase of the material. DX2 Geosyntex, Inc., will have the right to inspect and determine the cause of any alleged defect in the Liner and to take appropriate steps to repair or replace the Liner if a defect exists and is within the term of this Limited Warranty.

Any claim for any alleged breach of this warranty must be made in writing, by certified mail, to David Wise of DX2 Geosyntex, Inc., within (30) days after the alleged defect is first noticed. Should the required notice not be given, the defect and all warranties shall be deemed to have been waived by the Purchaser, and Purchaser shall have no right of recovery against DX2 Geosyntex Inc. In the event repairs and/or replacements are to be effected, said repairs and/or replacements shall not become due until the area subject to repair and/or replacement of Liner is available to DX2 Geosyntex, Inc., in a clean, dry, unencumbered condition. This includes, but is not limited to, the area made available for repair and/or replacement of Liner to be free from all water, dirt, sludge, residuals, and liquids of any kind.

DX2 GEOSYNTEX, INC., MAKES NO WARRANTY OF ANY KIND OTHER THAN THAT GIVEN ABOVE AND HEREBY DISCLAIMS ALL WARRANTIES, BOTH EXPRESS OR IMPLIED, OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

I hereby state I have read and understood the above and foregoing Limited Warranty and agree to such by signing hereunder:

Purchaser Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

DX2 Geosyntex Inc.'s, liability under this warranty shall in no event exceed the replacement cost of the material and installation sold to the Purchaser for the particular installation in which it failed. Further, under no circumstances shall DX2 Geosyntex, Inc., be liable for any special, direct, indirect, or consequential damages arising from loss due to personal injuries and product liability owing to the failure of the material or installation and no allowance will be made for repairs, replacements, or alterations made by the Purchaser without the express written consent of DX2 Geosyntex Inc.

DX2 Geosyntex, Inc., neither assumes nor authorizes any person other than an officer of DX2 Geosyntex, Inc., to assume for it any other or additional liability in connection with the LINER SYSTEM made the basis of the Limited Warranty. The Limited Workmanship Warranty on the Liner herein is given in lieu of all other possible material warranties, either express or implied, and by accepting delivery of the material, Purchaser waives all other possible workmanship warranties, except those specifically given.

The parties expressly agree that the sale hereunder is for commercial or industrial use only.

DX2 Geosyntex, Inc., Limited Workmanship Warranty is extended to the purchaser/owner and is nontransferable and non-assignable.

Purchaser acknowledges by acceptance that the Limited Workmanship Warranty given herein is accepted in preference to any and all other possible workmanship warranties.

DX2 Geosyntex, Inc.

**David Wise**

Title: Vice President

Sworn before me this 21st day of November, 2014

Signature: 



March 21, 2012

Bid #: 4066

**RE: Camilla, GA**

**PROPOSAL FOR INSTALLATION OF rPP LINER**

This Proposal for Installation of Membrane Lining System is submitted on behalf of Absorbent & Safety Solutions for the consideration for the project described herein. Absorbent & Safety Solutions is a specialist in the distribution and installation of membrane lining systems. This Proposal is intended to set forth all of the material terms and conditions upon which Absorbent & Safety Solutions will undertake and perform the Project. By executing this Proposal on behalf of Owner, Owner's authorized representative and Owner acknowledge and agree that upon acceptance, this proposal will become a legally binding contract with all material terms and conditions for Absorbent & Safety Solutions to undertake and perform the Project.

**1. THE "PROJECT."** Absorbent & Safety Solutions offers the following quotation to furnish and install the Liner system which is located in Camilla, GA. The following quote is for the Installation of the Membrane Liner System. Each line includes 560 LF of SS Batten.

**Furnish and Install Quote**

<b>400,000 SF 36 mil r-LLDPE</b>	<b>20 yr warranty</b>
<b>400,000 SF 36mil rPP</b>	<b>15 yr warranty</b>
<b>400,000 SF 45mil rPP</b>	<b>20 yr warranty</b>

**2. TERMS OF PAYMENT.** The following are the terms of payment for the Project:

- A.** Payment of stored material to be paid prior to mobilization. The remaining balance of contract is to be paid once project is complete.
- B.** Retainage is not permitted under this Proposal.
- C.** Absorbent & Safety Solutions retains the right to assess a late charge of 1.5% per month on any and all late payments.
- D.** No back charges shall be permitted under this Proposal.

**3. DURATION OF PRICE QUOTE.** The price quoted in this Proposal shall remain open for thirty (30) days.

**4. CONDITIONS OF PRICE QUOTE.**

**Camilla, GA**

**A.** The price quoted in this Proposal is based on one (1) mobilization with liner installation proceeding in a continuous, unencumbered manner. Should additional mobilizations be required, there will be a charge of \$3,500 per occurrence.

**B.** The price quoted in this Proposal is based on installing membrane on a prepared, compacted, DRY AND MAINTAINED subbase, which preparation, compaction, and maintenance shall have been performed by a third party or parties other than Absorbent & Safety Solutions. The subbase is to be dewatered by such third parties to a minimum of one (1) foot below slope liner subgrade surface to allow for a stable, firm, and dry subgrade. Field seaming quality and duration will be compromised if excessive moisture or standing water exists in/on liner subgrade soils.

**C.** The price quoted in this Proposal is for material F.O.B. job site.

**D.** The price quoted in this Proposal is for delivery of material during the 1st quarter of 2012 with installation during the 2nd quarter of 2012, weather permitting.

**5. SERVICES TO BE PROVIDED BY THIRD PARTIES AND/OR PROVIDED BY OWNER AT NO COST TO ABSORBENT & SAFETY SOLUTIONS.** The prices quoted in Section 1 of this Proposal **DO NOT** include the following services and/or charges that will be associated with the Project and must be provided by third parties and/or owner at no cost to Absorbent and Safety Solutions:

**A.** Owner shall be responsible for digging and backfilling the required anchor trench. In all cases where the liner penetrates below the top of any slope, any embankment above the liner penetration must be removed by owner and/or a third party other than Absorbent & Safety Solutions in order to create a bench to allow for access.

**B.** Owner shall be responsible for any and all permits, bonds, inspections, engineering services, licenses, permits, impact fees, and taxes necessary for the construction of the Project.

**C.** Owner shall provide the necessary heavy equipment and a third party operator of such equipment necessary to unload the materials necessary to complete the Project. The weight of the average roll of lining material is between 3,000 to 5,000 pounds.—Unloading of materials shall be performed so as not to damage the materials. Storage of the materials, once unloaded, shall be in accordance with Section 7 herein.

**D.** Owner shall provide the sand for filling necessary sandbags, and such sand shall be stored within a reasonable distance to each and every location where lining shall be installed. Absorbent & Safety Solutions will provide the sandbags.

**E.** Owner, either by itself or by using a third party dumpster service, shall provide a container on site for the disposal of all waste material including, but not limited to, cardboard cores, roll wrappers, scrap liners, and other waste materials.

**F.** Owner shall be responsible for any and all required or necessary testing, including but not limited to, conformance testing, by any outside agency (an independent laboratory testing service can be employed for the anticipated 5 seam samples—1 field seam sample per 500' of field seams created—for destructive peel and shear testing).

**Camilla, GA**

**G.** Owner shall be responsible for preparation, compaction, maintenance, and sterilization of the subbase, as more fully set forth in Section 4.B. herein.

**H.** Owner shall be responsible for providing surveying stakes to mark the limits of the liner installation.

**6. ACCESS TO SITE(S).** The Owner shall provide reasonable access in and around the site(s) including, but not limited to, the areas to be lined and all reasonable ingress and egress to and from such areas. In the event the location is not accessible in an unencumbered manner, Absorbent & Safety Solutions will not be responsible for damage to landscaping. Absorbent & Safety Solutions will take reasonable efforts to prevent damage to landscaping in mobilization to the location.

**7. STORAGE OF MATERIALS / SECURE WORK ENVIRONMENT.**

**A.** The area designed for storage of materials relating to the Project must be adjacent to and accessible to the site. The material storage area shall be smooth and free of all rock and shall be graded to allow surface water to flow away from such materials. It is critical that the materials be stored in an area that will remain dry.

**B.** Any and all costs incurred for the repair or cleaning of the materials that were improperly unloaded and/or improperly stored shall be the sole responsibility of Owner.

**C.** Owner acknowledges and agrees to provide Absorbent & Safety Solutions with a secure work environment and shall reimburse Absorbent & Safety Solutions for any and all damages to materials and/or equipment incurred as a result of vandalism, labor unrest, malicious mischief, Acts of God, or theft.

**8. CHANGE ORDERS.** Any and all change orders shall be in writing and signed by both Absorbent & Safety Solutions and Owner before Absorbent & Safety Solutions undertakes any changes in work.

**9. TIME FOR COMPLETION.** The Project shall be completed by Absorbent & Safety Solutions within a reasonable time; provided, however, that Absorbent & Safety Solutions shall not be responsible for delays due to acts of God, inclement weather, strikes, lockouts, material shortages, lack of availability of utility services, fire, storm, theft, vandalism, or other causes beyond the control of Absorbent & Safety Solutions.

**10. WARRANTY.** Absorbent & Safety Solutions shall provide a one (1) year labor warranty from the time of completion of this Project.

**11. INDEMNIFICATION.** Owner hereby indemnifies and holds Absorbent & Safety Solutions harmless from any and all claims relating to environmental contamination, including any and all attorneys' fees and costs incurred by Absorbent and Safety Solutions, with the exception of such claims that are proved to have directly resulted from improper installation by Absorbent and Safety Solutions.

**12. INDEPENDENT CONTRACTOR RELATIONSHIP.** After this Proposal has been executed by Owner's authorized representative, Absorbent & Safety Solutions shall be an independent contractor of Owner, and nothing in this Proposal is intended to or will create any form

**Camilla, GA**

of partnership, joint venture, or employment relationship between Absorbent & Safety Solutions and Owner.

**13. SUPERSEDES ALL PREVIOUS AGREEMENTS.** This Proposal, after it has been executed by Owner's authorized representative, shall supersede any and all previous negotiations and agreements, either oral or in writing, between Absorbent & Safety Solutions and Owner with respect to the Project.

**14. CHANGES IN WRITING.** After it has been executed by Owner's authorized representative, this Proposal shall not be changed or modified unless such changes or modifications are in writing and signed by Absorbent & Safety Solutions and Owner.

**15. UNENFORCEABLE PROVISIONS.** After it has been executed by Owner's authorized representative, if any term, covenant, warranty, section, clause, condition, or provision of this Proposal is held by a court of competent jurisdiction to be invalid, void, or unenforceable, the remainder of the provisions of this Proposal shall remain in full force and effect and shall in no way be affected, impaired, or invalidated, and this Agreement shall be construed as if the invalid, void, or unenforceable provisions were omitted.

**16. NO WAIVER OF RIGHTS.** Failure by Absorbent & Safety Solutions to insist on or enforce any of its rights shall not constitute a waiver of those rights by Absorbent & Safety Solutions, and nothing shall constitute a waiver of Absorbent & Safety Solutions' right to insist on strict compliance with the provisions of this Agreement.

**17. HEIRS AND ASSIGNS.** After it has been executed by Owner's authorized representative, this Proposal shall be binding on and inure to the benefit of the parties and their respective heirs, personal representatives, devisees, legatees, successors, and assigns.

**18. NOTICES.** After this Proposal has been executed by Owner's authorized representative, any notice, demand, or other communication (hereinafter collectively referred to as "Notice") required or desired to be given under this Proposal shall be in writing and shall be deemed to have been sufficiently given or served, for all purposes, if sent by certified or registered mail, return receipt requested, postage prepaid, to the following addresses:

**AS TO & SAFETY SOLUTIONS:**

**Absorbent & Safety Solutions, LLC**  
c/o Lenard Rodgers, Managing Member  
1917 Boothe Circle, Suite 131  
Longwood, Florida 32750

**AS TO OWNER**

**19. GOVERNING LAW / ATTORNEYS' FEES.** This Proposal is being executed and delivered in the state of Florida and shall be governed by and construed and enforced in accordance with the laws of the state of Florida. After it has been executed by Owner's authorized representative, if any dispute arises out of this Proposal, the prevailing party shall have the right to recover reasonable attorneys' fees, costs, and/or expenses from the non-prevailing party, including appellate attorneys' fees, costs, and/or expenses, whether such attorneys' fees, costs, and/or expenses were incurred before or during litigation, even if no formal litigation is ever initiated, or were incurred in any administrative proceeding, arbitration, mediation, or any proceeding in bankruptcy or insolvency.

**Camilla, GA**

**20. COUNTERPARTS.** This Proposal may be executed in as many counterparts as necessary, which counterparts may include facsimile signatures.

Absorbent & Safety Solutions appreciates this opportunity to assist you with your Geosynthetic requirements. Please feel free to contact our office at (407) 790-7816 if you have any questions regarding this Proposal.

If you agree to the terms of this Proposal, please sign where indicated below and return this Proposal to Absorbent & Safety Solutions at the address listed on the first page of this Proposal.

Sincerely yours,

*Jerry L. Reyome*

**Absorbent & Safety Solutions, LLC**  
Production Manager

**AGREEMENT TO TERMS OF PROPOSAL**

The undersigned authorized representative of Owner acknowledges and agrees that he or she is authorized to execute this Proposal and enter into this legally binding contract on behalf of Owner. Owner hereby agrees to the terms and conditions of this Proposal. By doing so, the undersigned authorized representative of Owner and Owner hereby acknowledge and agree that this accepted Proposal creates a legally binding contract for Absorbent & Safety Solutions, LLC to undertake and perform the Project for Owner.

By: \_\_\_\_\_

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_





# Product Certification

Product Name: Dura-Skrim K36B

Sales Order # 190008

Customer: IWT

Date: June 26, 2012

DURA<sup>®</sup>SKRIM K36B is a linear low density polyethylene geomembrane reinforced with a heavy encapsulated 1300 Denier polyester reinforcement. In addition to excellent dimensional stability the reinforcement provides exceptional tear and tensile strength.

DURA<sup>®</sup>SKRIM K36B are hereby certified to meet all current Raven Industries, Inc. published specifications, form 9/11 EFD 1251.

Note: Any resins used to make this product have met suppliers' certifications

Roll#	Length	Width	Grab Tensile	% Elongation	Tongue Tear	Puncture	Weight
			(lb.)		(lb.)	(lb.)	lbs/msf
			ASTM D7004	ASTM D7004	ASTM D5884	ASTM D4833	ASTM D5261
5798694	120	200	311 MD 308 TD	32	212 MD 142 TD	117	154
5798695	120	200	311 MD 308 TD	32	212 MD 142 TD	117	154
5804584	120	200	311 MD 309 TD	32	219 MD 160 TD	111	156
5804585	120	200	311 MD 309 TD	32	219 MD 160 TD	111	156
5805228	120	200	290 MD 277 TD	28	206 MD 148 TD	118	154
5805229	120	200	290 MD 277 TD	28	206 MD 148 TD	118	154
5809819	120	200	311 MD 308 TD	32	212 MD 142 TD	117	154
5809820	120	200	311 MD 308 TD	32	212 MD 142 TD	117	154
5810715	120	200	315 MD 316 TD	32	218 MD 166 TD	109	157
5810716	120	200	315 MD 316 TD	32	218 MD 166 TD	109	157

Pamela Weiler  
Senior Quality Assurance Technician  
Raven Industries - Engineered Films Division


**NOVA Chemicals®**  
**Certificate of Analysis**

NOVA CHEMICALS CORPORATION  
 JOFFRE POLYETHYLENE AST  
 PO Box 5006  
 JOFFRE AB T4N 6A1  
 Canada  
<http://www.novachemicals.com>

RAVEN INDUSTRIES INC  
 1809 E AVE  
 SIOUX FALLS SD 57104-0359  
 United States

May 03, 2012

Order No.:	651334	P.O.:	140787
Delivery No:	401453281/10		
Railcar/Container:	NCLX000165		
Shipping Date:	2012.05.04		
<b>Batch:</b>	<b>JS00043613</b>		
Product:	FG220-A HOPPER CAR 286		
Inspection Lot:	890000118675		
Mnfg. Date:	2012.02.01		
Quantity:	212,559 LB		

THE FOLLOWING TEST RESULTS WERE OBTAINED:

<b>Characteristic</b>	<b>Unit</b>	<b>Results</b>
Density	g/cm <sup>3</sup>	0.9202
Melt Index (190C/2.16kg)	G/10MI	2.30
Melt Flow Ratio(21.6kg/2.16kg)		26.40
Stress Exponent		1.28
Total Gels	ppm	2.98

For Shipment information or quality related issues in North America, please call NOVA Chemicals Customer Service to free at 1.866.BUY.NOVA (1.866.289.6682).

For all other countries, please call your designated Customer Service Specialist or the European Operating Center at +41.26.426.5757.

**Contact(s)**  
 Certs Efd

**Fax**

**E-mail**  
[efdcerts@ravenind.com](mailto:efdcerts@ravenind.com)


**NOVA Chemicals®**  
**Certificate of Analysis**

NOVA CHEMICALS CORPORATION  
 JOFFRE POLYETHYLENE AST  
 PO Box 5006  
 JOFFRE AB T4N 6A1  
 Canada  
<http://www.novachemicals.com>

RAVEN INDUSTRIES INC  
 1809 E AVE  
 SIOUX FALLS SD 57104-0359  
 United States

May 28, 2012

Order No.:	656111	P.O.:	141278
Delivery No:	401457075/10		
Railcar/Container:	NCLX003012		
Shipping Date:	2012.05.25		
<b>Batch:</b>	<b>JS00045238</b>		
Product:	FG220-A HOPPER CAR 286		
Inspection Lot:	890000129127		
Mnfg. Date:	2012.05.21		
Quantity:	212,559 LB		

THE FOLLOWING TEST RESULTS WERE OBTAINED:

<b>Characteristic</b>	<b>Unit</b>	<b>Results</b>
Density	g/cm <sup>3</sup>	0.9195
Melt Index (190C/2.16kg)	G/10MI	2.22
Melt Flow Ratio(21.6kg/2.16kg)		25.70
Stress Exponent		1.27
Total Gels	ppm	1.04

For Shipment information or quality related issues in North America, please call NOVA Chemicals Customer Service to free at 1.866.BUY.NOVA (1.866.289.6682).

For all other countries, please call your designated Customer Service Specialist or the European Operating Center at +41.26.426.5757.

**Contact(s)**  
 Certs Efd

**Fax**

**E-mail**  
 efdcerts@ravenind.com



# Product Certification

Product Name: Dura-Skrim K36B

Sales Order # 189994

Customer: IWT

Date: June 25, 2012 r1

DURA<sup>®</sup>SKRIM K36B is a linear low density polyethylene geomembrane reinforced with a heavy encapsulated 1300 Denier polyester reinforcement. In addition to excellent dimensional stability the reinforcement provides exceptional tear and tensile strength.

DURA<sup>®</sup>SKRIM K36B are hereby certified to meet all current Raven Industries, Inc. published specifications, form 9/11 EFD 1251.

Note: Any resins used to make this product have met suppliers' certifications

Roll#	Length	Width	Grab Tensile	% Elongation	Tongue Tear	Puncture	Weight
			(lb.)		(lb.)	(lb.)	lbs/msf
			ASTM D7004	ASTM D7004	ASTM D5884	ASTM D4833	ASTM D5261
5799642	120	200	311 MD 309 TD	32%	219 MD 160 TD	111	156
5799643	120	200	311 MD 309 TD	32%	219 MD 160 TD	111	156
5800550	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5800551	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5801457	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5801458	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5802379	120	200	308 MD 306 TD	32%	215 MD 149 TD	116	156
5802380	120	200	308 MD 306 TD	32%	215 MD 149 TD	116	156
5807036	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5798523	45	445	311 MD 308 TD	32%	212 MD 142 TD	117	154

Pamela Weiler  
Senior Quality Assurance Technician  
Raven Industries - Engineered Films Division

# DURA•SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene

**R A V E N**  
INDUSTRIES

## Product Description

DURA•SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA•SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

## Product Use

DURA•SKRIM® K30B, K36B and K45B are used in applications that require exceptional outdoor life and demand high tear strength and resistance to thermal expansion.

DURA•SKRIM® K30B, K36B and K45B are manufactured from a very chemical-resistant, Linear Low Density Polyethylene with excellent cold crack performance.

## Size & Packaging

DURA•SKRIM® K30B, K36B and K45B are available in a variety of widths and lengths to meet the project requirements. Large diameter mill rolls are available to assure an efficient seaming process. Factory welded panels are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time saving installation.



Containment Liner

Product	Part #
DURA•SKRIM .....	K30B
DURA•SKRIM .....	K36B
DURA•SKRIM .....	K45B

## APPLICATIONS

- |                         |                         |
|-------------------------|-------------------------|
| Waste Lagoon Liners     | Remediation Covers      |
| Floating Covers         | Landfill Caps           |
| Daily Landfill Covers   | Erosion Control Covers  |
| Modular Tank Liners     | Canal Liners            |
| Tunnel Liners           | Disposal Pit Liner      |
| Remediation Liners      | Water Containment Ponds |
| Earthen Liners          | Heap Leach Liner        |
| Interim Landfill Covers |                         |

# DURA♦SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene

PRO-FORMA DATA SHEET

PROPERTIES	TEST METHOD	DURA♦SKRIM K30B		DURA♦SKRIM K36B		DURA♦SKRIM K45B	
		Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages
APPEARANCE		Black	Black	Black	Black	Black	Black
THICKNESS		27 mil	30 mil	32 mil	36 mil	40 mil	45 mil
WEIGHT LBS/MSF, (OZ/YD <sup>2</sup> )		116 (16.7)	125 (18.0)	136 (19.6)	155 (22.3)	175 (25.2)	200 (28.8)
CONSTRUCTION		Dense scrim reinforced polyethylene					
*PLY ADHESION - LBF/IN	ASTM D 6636	17 or FTB	20 or FTB	21 or FTB	28 or FTB	24 or FTB	32 or FTB
TENSILE STRENGTH - LBF/IN	ASTM D 7003	165 MD 159 TD	182 MD 170 TD	170 MD 166 TD	186 MD 175 TD	178 MD 170 TD	195 MD 180 TD
TENSILE ELONGATION AT BREAK % (FILM BREAK)	ASTM D 7003	480 MD 430 TD	540 MD 500 TD	500 MD 450 TD	575 MD 520 TD	520 MD 470 TD	590 MD 550 TD
TENSILE ELONGATION AT BREAK % (SCRIM BREAK)	ASTM D 7003	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD
TONGUE TEAR STRENGTH - LBF	ASTM D 5884	185 MD 160 TD	195 MD 185 TD	160 MD 120 TD	180 MD 140 TD	140 MD 120 TD	175 MD 145 TD
GRAB TENSILE - LBF (SCRIM BREAK)	ASTM D 7004	260 MD 245 TD	270 MD 255 TD	280 MD 270 TD	300 MD 290 TD	260 MD 245 TD	270 MD 255 TD
GRAB TENSILE ELONGATION AT BREAK % (SCRIM BREAK)	ASTM D 7004	25	32	25	32	25	32
HIGH PRESSURE OIT (HPOIT)	ASTM D 5885	1000 min	2400 min	1000 min	2400 min	1000 min	2400 min
PUNCTURE RESISTANCE - LBF	ASTM D 4833	85	100	110	120	120	133
MAXIMUM USE TEMPERATURE		180° F		180° F		180° F	
MINIMUM USE TEMPERATURE		-70° F		-70° F		-70° F	

\*Raven modified QC procedure

PRO-FORMA Sheet Contents:

The data listed in this Pro-Forma data sheet is representative of initial production runs. These values may be revised at anytime without notice as additional test data becomes available.



DURA♦SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA♦SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage.





# Destructive Test Log

Project Name: \_\_\_\_\_ Camilla Preservation Site

Site Supervisor: Jerome Fusion (ppi)

Location: \_\_ Camilla, GA

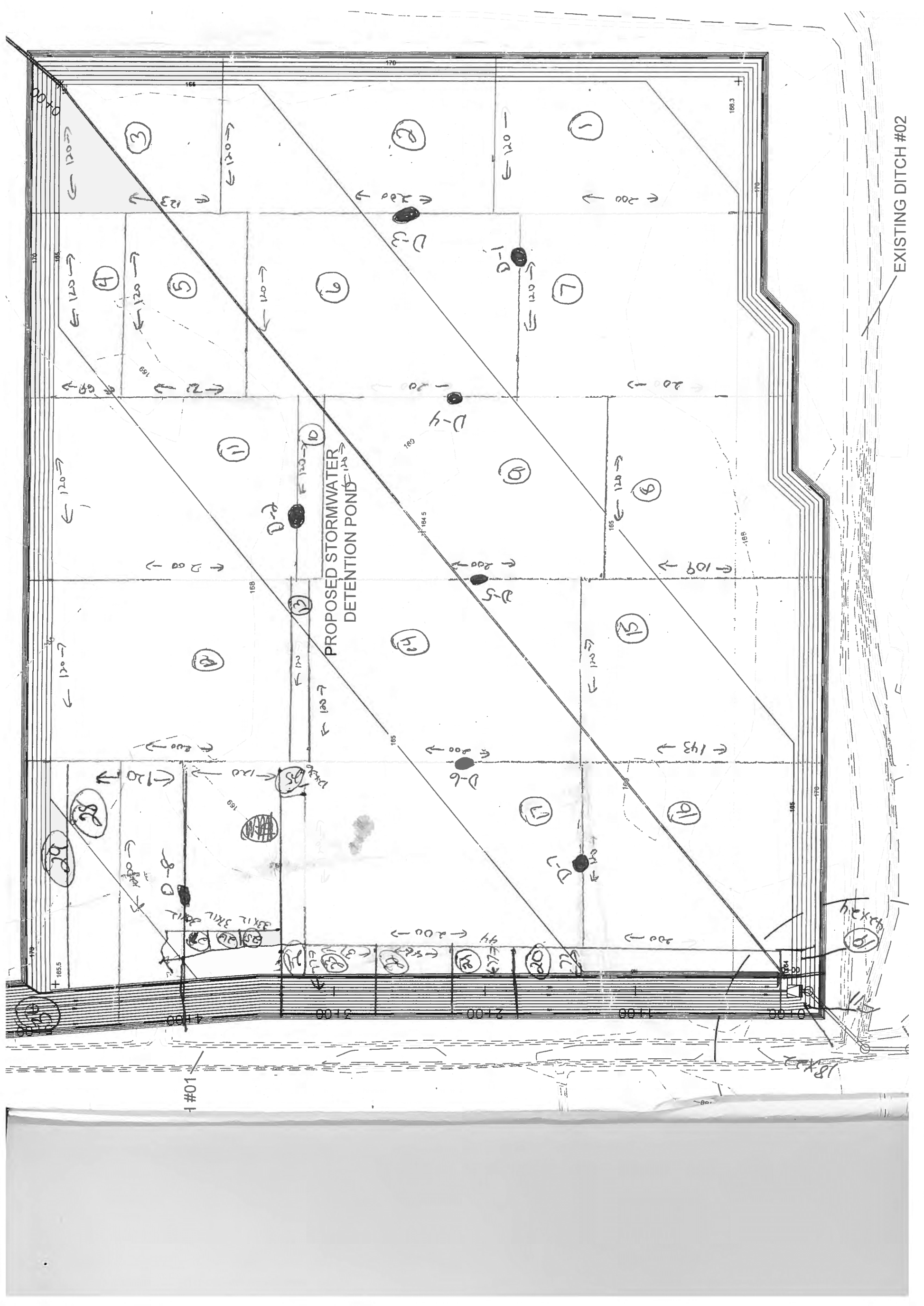
Type of Material: LLDPE Min. Peel \_\_ 45

Job Number: \_\_\_\_\_

Sheet Thickness: 36mil Min. Shear\_\_ 75

Q.A. Tech.: \_\_\_\_\_ Jerry Reyome

Sample Number	Date Welded	Location	Technician ID Number	Machine Type & No.	Temp/Speed	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	Pass / Fail
1	20-Oct	on as-built	1	Dual Wedge 1	600/850	108	72	108	81	102	118	176	140	143	111	PASS
2	20-Oct	on as-built	1	Dual Wedge 1	600/850	70	55	57	65	67	82	85	69	87	78	PASS
3	21-Oct	on as-built	1	Dual Wedge 1	600/850	75	67	50	76	46	90	148	104	78	85	PASS
4	21-Oct	on as-built	1	Dual Wedge 1	600/850	73	86	49	83	71	98	106	88	75	77	PASS
5	21-Oct	on as-built	1	Dual Wedge 1	600/850	54	78	44	68	53	81	78	98	85	61	PASS
6	22-Oct	on as-built	1	Single Wedge 1	600/850	63	62	72	80	72	86	79	83	96	82	PASS
7	22-Oct	on as-built	1	Single Wedge 1	650/750	100	66	69	71	71	95	108	117	102	80	PASS
8	23-Oct	on as-built	1	Single Wedge 1	650/750	69	61	56	49	90	109	92	111	112	96	PASS



EXISTING DITCH #02

PROPOSED STORMWATER  
DETENTION POND

#01

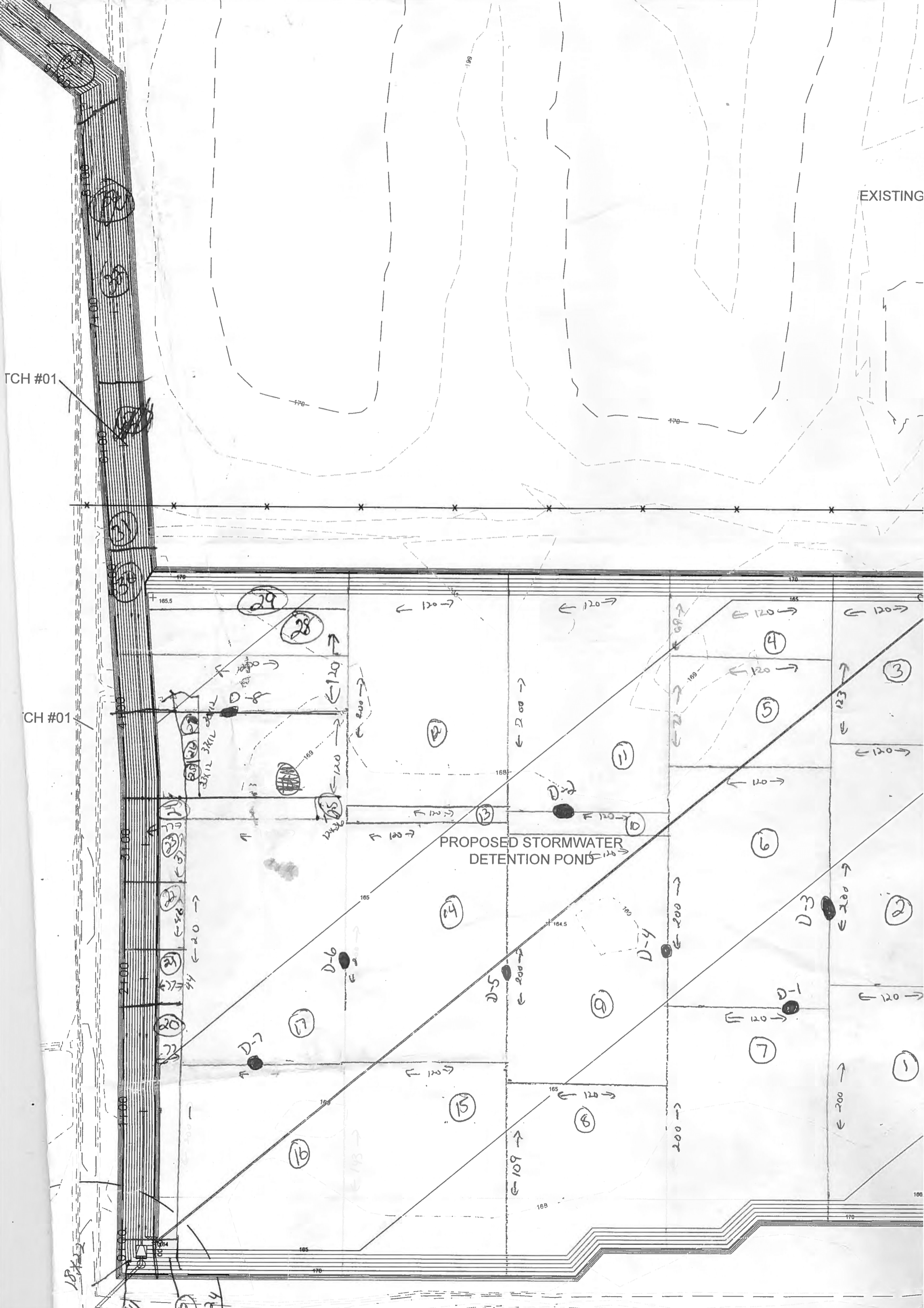
18x22

EXISTING

TCH #01

CH #01

PROPOSED STORMWATER  
DETENTION POND



# OPERATIONS AND MAINTENANCE (O&M) PLAN

REVISION 1

Camilla Wood Preserving Site

Camilla, Mitchell County, Georgia

**Prepared Under:**

**U.S. EPA Contract No.** EP-S4-09-02

**U.S. EPA Task Order No.** 062-RARA-04QG

**Black & Veatch Project No.** 049062.01.41.01.03

**DCN:** 49062-0150-04-A-02367R0

**Prepared For:**

**U.S. Environmental Protection Agency Region 4**

Superfund Division

Atlanta, Georgia



**Prepared By:**

**Black & Veatch Special Projects Corp.**

1120 Sanctuary Parkway, Suite 200

Alpharetta, Georgia 30009



**BLACK & VEATCH**  
Building a **world** of difference.®

**February 2018**

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## Acronyms and Abbreviations

%	percent
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
bgs	below ground surface
Black & Veatch	Black & Veatch Special Projects Corp.
COC	Chemical of Concern
cy	cubic yards
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
ERRB	Emergency Response and Recovery Branch
FS	Feasibility Study
ft	feet/foot
GAEPD	Georgia Environmental Protection Division
GCL	Geosynthetic clay liner
GDOT	Georgia Department of Transportation
HRS	Hazard Ranking System
IC	institutional control
ISCO	<i>in situ</i> chemical oxidation
NPL	National Priorities List
O&F	Operational & Functional
O&M	Operations and Maintenance
ORP	oxidation-reduction potential
Owner	City of Camilla
PCP	pentachlorophenol
pH	hydrogen ion concentration
PPE	Personal Protective Equipment
psi	pounds per square inch
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SESD	Science and Ecosystem Support Division
Site	Camilla Wood Preserving Site

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## 1.0 Introduction

Ongoing maintenance is critical for ensuring continued effectiveness of the various remedy components constructed at the Camilla Wood Preserving Site (Site). Ideally, a local program should address operations and maintenance (O&M) concerns proactively instead of reacting to problems. O&M activities can include mowing, re-seeding, cleaning and maintenance of the perimeter drainage ditches, inspection and repair of monitoring wells and associated equipment, inspection and repair of transducer array elements, routine groundwater monitoring and other structural controls.

### 1.1 INTENT OF DOCUMENT

Black & Veatch Special Projects Corp. (Black & Veatch) has prepared this Post-Construction O&M Manual for the Site for the U.S. Environmental Protection Agency (EPA), Georgia Environmental Protection Division (GAEPD) and the City of Camilla (City). This manual is a supplement to the Remedial Action (RA) report documents submitted to the EPA under separate cover. Construction activities relating to the barrier wall were completed during 2013. Construction activities relating to the containment cell cap began in 2013 and were completed in early 2014. Construction activities relating to the concrete foundations began in early 2014 and were completed in late 2014. *In situ* chemical oxidation (ISCO) construction activities began in early 2014 and were completed in late 2014 with additional injection activities occurring in early 2016.

This manual is intended for use by the EPA, GAEPD and the City of Camilla for the physical maintenance of the low permeability barrier wall, engineered cap, cap perimeter drainage ditches, transducers and monitoring wells located at the Site. An O&M Manual for the Site storm water collection system and detention pond were submitted in April, 2016. General components of the remedy addressed in this O&M Manual include the following:

- Inspection and maintenance of installed remedial systems, including monitoring wells, pressure transducers and related equipment.
- Completion of routine groundwater monitoring activities.
- Inspection and maintenance of the final cover, rip rap lined perimeter ditches, and concrete foundations.
- Site security for protection of remedial systems.
- Enforcement of deed restrictions applied to the Site.

This section briefly summarizes the background information for the Site. This section also describes general post-construction care requirements in accordance with GAEPD to identify when and how the post-construction care period begins and ends.

### 1.2 SITE LOCATION

The Site is located in the community of Camilla, Mitchell County, Georgia, approximately 0.25 miles west of U.S. Highway 19, bordered by South Harney Street to the west, railroad tracks to the east and Bennett Street to the north. A Georgia Department of Transportation (GDOT) facility and City of Camilla landfill border the facility to the south. The Site is comprised of an approximately 41-acre area. The adjacent properties located to the south of the eastern portion of the Site (including the GDOT facility and a former City dump) comprise approximately 11 acres. The western portion of the site, comprising approximately 23 acres, was remediated by EPA in 2006 and currently serves as an athletic complex,

including soccer fields, a storm water detention pond and administrative offices for Mitchell County Recreation. The site location and site layout are shown on Figures 1-1 and 1-2, respectively.

### 1.3 SITE HISTORY

Wood treating operations began at the Site in 1947. The facility was constructed by the Louis Wood Preserving Company on land that was previously a cypress swamp. In 1950, the Escambia Treating Company purchased the property and continued wood preserving operations. In 1985, through a series of corporate reorganizations and stock transfers, International Utility and Supply Corporation assumed control of the company and facility operations. The Escambia Treating Company retained the surface impoundments and their associated environmental liabilities. At that time, the name of the operating company was changed to Camilla Wood Preserving, Inc. On February 8, 1991, Camilla Wood Preserving, Inc., filed for bankruptcy protection, and on February 26, 1991, the facility closed.

During 44 years of wood treating operations, the facility prepared trees for treatment by debarking, cutting to size, and drilling holes. Treatment consisted of using trams to load peeled poles into two pressure treating cylinders, and then steaming the poles for ten hours. A vacuum was then applied to the cylinders to remove water from the poles. Following the vacuum (dewatering) stage, approximately 25,000 gallons of treating solution was pumped into the treatment cylinders through aboveground pipes. The treating solution, either creosote or a solution of ten percent (%) pentachlorophenol (PCP) in diesel fuel, was forced into the poles through pressurization. The poles were treated for a variable amount of time, depending on their moisture content. After treatment, the poles were removed to the drip area located in the vicinity and south of the railroad tracks for drying and storage.

Wastewater was generated throughout the process, in particular during the steam treating process (part of the dewatering step), preservative recovery, the cleansing of drums, storage tanks, and the production area. Initially, the wastewater was collected in unlined impoundments located in the northeastern portion of the Site near the corner of Thomas and Bennett Streets. Later, the waste streams were treated in an onsite wastewater treatment system, before being discharged to the City of Camilla's wastewater treatment plant. The location of the municipal sewer connection is undetermined but is believed to be located on the north side of the Site along Bennett Street.

#### 1.3.1 Removal Activities

After facility closure in 1991, the EPA Region 4 Emergency Response and Recovery Branch (ERRB) secured the Site by placing a fence around the perimeter. Water from a storage impoundment was pumped into a storage tank located at the wastewater treatment area. In addition, approximately 50,000 gallons of wastewater were discharged to the City of Camilla's wastewater treatment system. During site stabilization efforts, drums were gathered and staged onsite and the impoundment area was backfilled with onsite soils. Approximately 25% of the impoundment area remained open and contained sludge (Black & Veatch, 2011).

In 1992, approximately 95,000 gallons of wastewater were treated onsite, the sludge in the impoundment was solidified, and the impoundment was capped (Black & Veatch, 2011).

In 1994, the EPA initiated treatment of site standing water and the dismantling of the process facility. Approximately 522,000 gallons of water were treated and discharged to an onsite evaporation pond. Additionally, 30,723 gallons of PCP and creosote were removed from onsite tanks and shipped offsite for disposal. In October 1994, approximately 5,000 cubic yards (cy) of soil were removed from a site parking lot, an easement along Bennett Street, and four residential properties across Bennett Street.

The removal was based on the results of dioxin sampling and soil stockpiled in a lined, bermed, onsite staging area (Black & Veatch, 2011).

In 1995, the remainder of contaminated soils was removed, completing the soil removal activities that were initiated in 1994. Approximately 5,000 tons of soil was shipped offsite for disposal (Black & Veatch, 2011). A Hazardous Ranking System (HRS) Package was prepared for the Site in June of 1995. After review of the HRS Package, the Site was proposed to the National Priorities List (NPL) in 1998. The previous soil and sediment contamination on the western portion of the Site has been addressed through a soil removal action and ditch remediation which was conducted in 2006 and 2007 by EPA. The removal action included the removal and disposal of the former pole barn structures, the excavation of a minimum of one foot (ft) of soil in previously identified contaminated areas of the Site, re-grading with a minimum of one ft of clean fill in excavated areas, capture and relocation of several species inhabiting the onsite ditches, excavation of contaminated ditch sediments, and additional ditch channel improvements.

### **1.3.2 EPA Emergency Response Action**

The previous soil and sediment contamination on the western portion of the Site has been addressed through a soil removal action and ditch remediation which was conducted in 2006 and 2007 by EPA. The removal action included the removal and disposal of the former pole barn structures, the excavation of a minimum of one ft of soil in previously identified contaminated areas of the site, re-grading with a minimum of one ft of clean fill in excavated areas, capture and relocation of several species inhabiting the onsite ditches, excavation of contaminated ditch sediments, and additional ditch channel improvements. Excavated soils and sediments were either transported to an offsite disposal facility or placed on the eastern portion of the Site to be addressed along with the soil remedy for the eastern portion of the Site. Approximately 10,000 cy of soil were placed in a lined and capped soil pile on the eastern portion of the Site. These soils were to be addressed as part of the remedy for the in-place soils on the eastern portion of the Site (Black & Veatch, 2011).

### **1.3.3 Site Investigations**

Numerous investigations of the Site have occurred since the facility ceased operations in February 1991. In May, June, and July 1997, under the direction and oversight of the GAEPD, Ecology and Environment Inc. conducted a site assessment to characterize soil and groundwater contamination in the extreme northeastern portion of the Site. Results indicated that elevated levels of wood treating solution compounds (Resource Conservation and Recovery Act [RCRA] K001), historically used at both facilities, were present in the underlying soil and groundwater. A Remedial Investigation (RI)/Feasibility Study (FS) was completed in 2009, which summarized the nature of the contaminants and identified, evaluated and recommended remedial alternatives for the Site. Remedial design (RD) investigations were conducted in 2009 through 2011 and summarized by the RD Basis of Design Report (Black & Veatch, 2011). Annual groundwater sampling events have also occurred at the Site from 2006 through 2017.

## **1.4 REMEDIAL ACTION OBJECTIVES**

Following are the Remedial Action Objectives (RAO) for the Site:

- Prevent ingestion, inhalation, or direct contact with surface soils that contain concentrations in excess of the performance standard.

- Control migration and leaching of contaminants in site soils and sediments to groundwater that could result in future groundwater contamination in excess of drinking water standards and/or health-based levels.
- Prevent ingestion or inhalation of soil particles in air that contain concentrations in excess of the performance standard.
- Control future releases of contaminants to ensure protection of human health.
- Prevent ingestion of groundwater having concentrations in excess of drinking water standards and/or health-based levels.
- Restore the groundwater aquifer to drinking water standards and health-based-levels.
- Control migration and leaching of contaminants from site soils, sediments, and groundwater to surface water that would exceed surface water quality standards.

## 1.5 O&M REQUIREMENTS

### 1.5.1 O&M Activities

Required long term O&M activities are the responsibility of the City of Camilla, Mitchell County, GAEPD and EPA. Activities covered in this document include:

- Inspection of the constructed caps/covers and the stormwater conveyance systems.
- Maintenance of the integrity of the caps/covers, including routine mowing, fertilizing the soil, and making repairs to the cover system, as necessary, and correcting the effects of settling, subsidence, erosion, or other events.
- Monitoring groundwater elevations within and outside the capping system.
- Prevent surface water run-on and runoff from eroding or otherwise damaging the cap.
- Ensure that the on-site institutional controls (ICs) are enforced.

Section 3.0 discusses the specifics on how site O&M is to be performed for these tasks.

At a minimum, O&M activities require maintenance of all inspection reports prepared for the EPA and GAEPD, or other party(ies) as required. Field reports documenting inspections and in-house records, such as laboratory analytical reports and contractor's logs, are to be maintained as hard copy and electronically for EPA and GAEPD, so that appropriate documentation will be available to certify that site care is being conducted.

## 1.6 ENVIRONMENTAL HEALTH AND SAFETY

In accordance with EPA regulations, after construction, the owner (City of Camilla) will comply with post-construction requirements, including maintenance and monitoring throughout the post-construction care period. No one shall dig into, excavate, or otherwise disturb the barrier wall or containment cell cap without first notifying EPA and GAEPD. At a minimum, the following personal protective equipment (PPE) should be worn during O&M inspections:

- Safety glasses with side shields meeting the requirements and specifications of the current American National Standards Institute (ANSI) Z87 standard.

- Safety-toed boots meeting the requirements and specifications for impact and compression resistance, as required by American Society for Testing and Materials (ASTM) F2412/F2413 (formerly ANSI Z41, Class 75, for footwear purchased prior to March 2005).

## **1.7 ORGANIZATION OF THIS MANUAL**

This manual discusses site-specific needs to operate, provide appropriate upkeep, and maintenance of the installed RA construction items including the facilities, equipment, and appropriate engineered and ICs pertaining to post-construction at this Site. The text references GAEPD requirements as well.

The format of this manual provides an easy reference to specific O&M topics. Section 2 presents an overview of the design and functional description of key components of the remedy, Section 3 describes Site monitoring, inspection, and maintenance procedures, and Section 4 provides references.

Appendices are included at the end of this manual to provide supporting documentation. Appendix A contains the relevant figures and As-Built surveys from the Site RA Report (Black & Veatch, 2015). Appendix B provides copies of manufacturer's catalog data detailing specific liners/equipment installed at the Site as part of the construction project. Appendix C contains typical details of wells installed during the RA. Appendix D provides information pertaining to the grass seed used for the vegetative cap cover.

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## 2.0 Design and Function of the Remediation Components

### 2.1 INTRODUCTION

This section presents an overview of the design and functional description of the following key elements of the Site RA, specifically the construction of a low permeability barrier wall and augmented clay cap, an engineered containment cell cap with drainage system, concrete foundations which will be integrated into a future recreational complex by Mitchell County and an ISCO well network that has been used to deliver oxidant to the subsurface. Primary components of the remedy include:

- Installation of a 2,600 linear ft by 40 ft deep on average low permeability barrier wall around the most contaminated portion of the Site
- Installation of an augmented clay cap and biaxial geogrid over the barrier wall
- Power screening, placement, and compaction of 40,000 cy of contaminated soil previously stockpiled within the footprint of the barrier wall
- Raising of existing monitoring wells within the footprint of the barrier wall
- Installation of a geosynthetic clay layer (GCL) above the graded contaminated soil
- Installation of a geocomposite drainage layer above the GCL
- Placement of at least a 3 ft thick clean soil layer over the drainage layer followed by placement of a 6 inch topsoil layer and site seeding
- Placement of a cap perimeter drain system
- Installation of rip rap lined channels on the cap slopes to enhance surface water shedding from the cap
- Installation of seven groundwater performance monitoring wells
- Injection of approximately 300,000 gallons of potassium permanganate into the subsurface
- Installation and operation of an array of pressure transducers around the barrier wall and capped area
- Installation of concrete foundations for future use by the City of Camilla and Mitchell County
- *In situ* groundwater treatment using chemical oxidation (ISCO) to enhance natural degradation of site contaminants in groundwater outside the engineered cap
- Long-term monitoring to ensure that the remedy is protective of human health and the environment. This monitoring includes groundwater sampling outside the slurry walls, and hydraulic head measurements collected from both inside and outside the slurry walls to ensure the integrity of the slurry walls.
- Engineering controls to control surface water runoff, dust, air quality, etc. and ensure that RAOs are met during and after putting the remedy in place.
- ICs to restrict future land use and groundwater use, as necessary. These controls shall also restrict future activity at the Site that would compromise the effectiveness of the remedy.

Drawings showing the location and details of the constructed remedial systems listed above are included in Figures 1-2 and 2-1, 2-2 and in Appendix A.

## 2.2 SUBSURFACE BARRIER WALL

Construction of a vertical subsurface barrier wall began in February 2013. The barrier wall was installed to a total average depth of approximately 40 ft below ground surface (bgs), but the actual depth ranged from 24 ft to 46 ft bgs. The depth varied according to the presence of shallow competent limestone layers that resulted in excavator refusal. The bottom of the slurry wall extended 3 to 5 ft into a competent clay or limestone unit continuously along the slurry wall alignments. The total length of the installed barrier wall is 2,536 linear ft. Based upon field conditions encountered, such as proximity to roadways or other features and equipment capabilities, the alignment of the barrier wall was installed along a slightly different alignment than designed.

Approximately 2,000 cy of excess spoils were generated from the barrier wall construction that subsequently required stabilization. Due to historic rainfall events during the construction of the barrier wall, there were several areas of the Site, including where the excess wall spoils were placed, that were extremely soft and not suitable for use. These soils were amended with fly ash and mixed thoroughly prior to reuse onsite. Upon completion of each section of the barrier wall trench excavation, the slurry wall section was backfilled with the design mix of native clay soils with 5% bentonite slurry and 1% dry bentonite powder. Installation of the barrier wall was completed in April 2013.

Following completion of the wall construction and backfilling, a survey was conducted to document the final as-built location of the barrier wall. The as-built barrier wall alignment may be found in Appendix A.

## 2.3 ENGINEERED CAP

Activities associated with construction of the engineered cap over the 10-acre containment cell began in May 2013. Due to the cap construction following immediately after the barrier wall installation, the barrier wall did not have a full 60 days of curing time before traffic over the wall was anticipated. To ensure that the barrier wall would not be damaged by truck traffic traversing the top of the wall, a 10-ft wide protective cap, centered on the barrier wall, was constructed to a depth equal to the top of the barrier wall (approximately 2 ft bgs). The cap was constructed by lining the shallow excavation with a biaxial geogrid, then backfilling with imported clay and compacting the material to 100 pounds per square inch (psi) as measured with a pocket penetrometer. At the main site entrance, this trench was backfilled with imported clay soils that were amended with Portland cement and compacted to a minimum of 100 psi as measured with a pocket penetrometer.

Approximately 40,000 cy of contaminated soil generated during previous phases of work had been stockpiled within the footprint of the barrier wall for use as fill material during construction of the cap. It was determined that the soils in the stockpile were not suitable for use beneath the engineered cap due to the high volume of metal and wood debris. A power screen was used to remove the excess debris from the contaminated soil stockpile prior to construction of the cap. Between May 2013 and July 2013, approximately 40,000 cy of soil were power screened and approximately 12 truckloads of concrete and wood debris were removed from the contaminated stockpile and disposed of offsite.

The composite cap consisted of screened soil placed and compacted in lifts, a geosynthetic liner, a geonet drainage layer, a minimum of 3-ft thick common fill soil layer placed and compacted in lifts, a 6-inch to 9-inch topsoil layer, and a vegetative cover. The total area of the engineered is approximately 10 acres. As-built drawings of the engineered cap may be found in Appendix A.

## 2.4 INSTALLATION OF FINAL SITE FINISHES

In 2013 through 2015, a reuse for the site was designed. Per discussion with the City of Camilla and Mitchell County Recreation, the site reuse plan included a Little League baseball Tournament Complex, concession stands, walking trails and a playground. Construction of the components included in the reuse plan began in October 2014 and included the following:

- Six high-mast light pole foundations, approximately 18.5 ft deep
- Twelve parking and pedestrian light pole foundations, approximately 12 ft deep
- Four 110-linear ft spread footings in support of 24-ft high backstop fencing, installed to approximately 2.5 ft bgs
- Eight 6 ft x 8 ft spread footings for the dugouts at each field, installed to approximately 2 ft bgs
- Fence post foundations for the field and perimeter fencing, approximately 2 ft bgs

The foundations for four backstops and eight dugouts were laid out, excavated to the proper depth and framed for the placement of rebar cages and placement of concrete. Each of the four fields had a backstop and two dugouts installed per the approved drawings. The foundations of these structures did not penetrate the GCL. The soil excavated from these foundations was clean and was used to backfill around the poured foundations

The foundations for the fencing installation did not penetrate the GCL liner. Twenty four-inch diameter holes were drilled to an average depth of thirty inches then filled with concrete. Once the concrete was poured, fence post sleeves were installed at the correct depth and location.

The foundations for the athletic field, parking area and pedestrian area lighting required excavation to a depth below the GCL. Soil removed above the GCL was uncontaminated and was stockpiled and used for backfill. The contaminated soil excavated from beneath the cap was placed into a lined stockpile area.

Due to the depth of the excavations for the high-mast light poles, groundwater was encountered in two of the holes drilled. Groundwater was allowed to collect until it was time to backfill the holes with concrete and then the water was pumped into a holding tank and the concrete immediately placed into the hole. The foundations for both the sports field lighting, pedestrian lighting, and the parking lot lighting were backfilled with clean soil once the placement of the sonotube form was positioned at the correct depth. After placement of the sonotube and prior to the placement of soil, new GCL material was used to patch around the excavation and the sonotube to make sure that the liner was sealed back over the contaminated soil.

The contaminated soils and groundwater removed from beneath the GCL were collected and analyzed prior to disposal. Approximately 195 tons of contaminated soil was stockpiled in a designated location where it was sampled and analyzed for characterization. 300 gallons of contaminated groundwater was pumped into a frac tank for storage where it was sampled and analyzed for characterization. The sample results indicated that both the soil and water could be disposed of offsite and non-hazardous waste. Each waste stream was transported and disposed accordingly at an approved off-site disposal facility.

Ten rip-rap lined spillways were installed around the perimeter of the site to help with the drainage of the water from the cap. The spillways were constructed by removing six to eight inches of soil from the

slope of the cap and placing a geosynthetic liner prior to placement of six to eight inches of rip rap rock within the spillway. The Site was graded and all disturbed areas were hydro seeded to complete the work.

## **2.5 GROUNDWATER REMEDIATION SYSTEM**

In addition to the barrier wall and engineered cap described in Sections 2.2 and 2.3, the Site has a groundwater remediation system using ISCO to treat contaminated groundwater outside the engineered cap. The system consists of a total of 47 wells installed in 2014. The wells, as shown on Figure 1-2 and Figure 2-1, include 36 injection wells, 2 extraction wells, 7 performance monitoring wells (monitoring wells located within the ISCO treatment area), and 2 sentinel monitoring wells. Between 2014 and 2016, approximately 300,000 gallons of potassium permanganate solution were injected into the Site subsurface to foster destruction of the chemicals of concern (COCs) present in the intermediate groundwater. EPA is responsible for maintaining the groundwater remediation and monitoring system for 10 years. At the end of this period, GAEPD will be responsible for monitoring groundwater as discussed in this document.

## **2.6 POST-CLOSURE GROUNDWATER MONITORING PROGRAM**

To accomplish the monitoring goals specified in the Record of Decision (ROD; EPA 2009), the post-closure monitoring program will include:

- Measurements of the water levels and calculation of groundwater elevation in monitoring wells inside and outside of the barrier wall / engineered cap.
- Sampling and analyses of wells down gradient of the containment area to evaluate the trends in groundwater quality which will indicate the effectiveness and integrity of the barrier wall (this task will be conducted by EPA through 2022, after which the state will assume this responsibility).

Monitoring wells will also be used for groundwater elevation monitoring. Table 2-2 includes well construction information for all of the onsite monitoring wells. Figure 2-2 shows the locations of the wells. Table 2-3 presents a summary of monitoring points and monitoring frequency. Results of post-closure monitoring will be evaluated and reported annually. At the completion of five years of post-closure monitoring, the program will be thoroughly evaluated to determine if changes in the program are warranted.

## 3.0 Site Monitoring, Inspection, and Maintenance

### 3.1 GENERAL

This section addresses inspection, monitoring, and maintenance procedures for the site monitoring elements. O&M, as addressed in this plan, includes considerations for groundwater monitoring, inspections, mowing, and other types of maintenance. This plan specifies reasonable monitoring and maintenance activities for the site facilities.

### 3.2 O&M

The Operational and Functional (O&F) milestone for portions of the remedy, including the barrier wall and cap system, officially began on September, 2016. This date triggered the beginning of GAEPD's O&M. O&M for the containment areas will continue indefinitely unless changed by a bilateral agreement between EPA and GAEPD. O&M will be conducted in accordance with the EPA and GAEPD regulations.

### 3.3 USE OF PROPERTY

ICs will be used to insure the long-term integrity of the containment cell. The restrictive covenant will state that no one shall dig into, excavate, or otherwise disturb the containment cell and the 3-ft of clean soil capping the containment cell, without first notifying and obtaining approval from EPA and GAEPD. Further, the covenant will state that no one will construct any groundwater wells within the restricted portions of the Site or use the shallow groundwater on-site for any purpose. A 6-ft chain link security fence surrounding the containment cell serves to restrict access and use of the Site.

#### 3.3.1 Inspection, Monitoring, and Maintenance Requirements

Compliance with O&M and Site care requirements, including inspection, maintenance, and monitoring will be required. Throughout the O&M period, the GAEPD will monitor the effectiveness of the remedial measures throughout the life of the remedy. Inspection, monitoring and maintenance requirements for the O&M include:

- Maintaining the integrity of the final cover, including making necessary repairs to the cover components and cap penetrations, to correct the effects of settling, subsidence, erosion or other events.
- Monitoring the effectiveness of the cover system.
- Monitoring the effectiveness of the containment cell.
- Preventing surface water run-on and runoff from eroding or otherwise damaging the cap.
- Ensuring that the security of the monitoring wells is maintained.
- Ensuring the engineering controls and institution controls are being enforced.

#### 3.3.2 Inspections

Inspections should be performed on a regular basis (e.g. monthly, semi-annually, or annually) and may be adjusted based upon ongoing observations of the remedial remedy elements. A schedule of required inspections is included on Table 3-1.

### 3.3.3 Maintenance Scheduling and Performance

Maintenance activities can be divided into two types: scheduled and corrective. Scheduled maintenance tasks are those that are typically accomplished on a regular basis such as monthly or quarterly. These items consist of such things as vegetation maintenance (such as grass mowing) and trash and debris removal from the perimeter drainage ditches. These tasks are required at well-defined time intervals.

Corrective tasks consist of items such as cap slope erosion repair that is done on an as-needed basis. These tasks are typically scheduled based on inspection results. Corrective maintenance sometimes calls for more specialized expertise and equipment than for scheduled tasks.

## 3.4 INSPECTION ITEMS, FREQUENCY, AND ROUTINE MAINTENANCE

Inspections and maintenance will be conducted as specified in this O&M Plan. Small problems that can easily worsen to more significant problems should be addressed and repaired in a timely manner. The following items will require periodic inspection and maintenance:

- Maintaining the integrity of the final cover, including making necessary repairs to the cover components, to correct the effects of settling, subsidence, erosion or other events
- Monitoring the effectiveness of the cover system
- Monitoring the effectiveness of the low permeability barrier wall
- Preventing surface water run-on and runoff from eroding or otherwise damaging the cap
- Ensuring that the security of the monitoring wells is maintained
- Ensuring the engineering controls and ICs are being enforced
- Perimeter storm water ditches
- Concrete foundations
- Site security facilities
- Vegetative cover

Table 3-1 presents a summary of many of the potential problems typically associated with each of the above listed items and associated schedule of inspection. The inspection schedule is approximate. Table 3-2 presents a schedule of routine, preventive maintenance items typically required for each of the above items. The schedule for routine maintenance is approximate and may be revised, based on operator experience, to an as needed basis. Table 3-3 presents a summary of suggested O&M inspection items and the party responsible for each inspection. Table 3-4 presents an example report form that may be used to document O&M inspections. Table 3-5 presents an inspection log that may be used by the inspector to document completion of each inspection. Table 3-6 presents a summary of the estimated costs for years 1-30 of the recommended O&M program.

## 3.5 INSPECTION REPORTING

An inspection log with explanations of observations made will document each inspection and become part of the operating records for the RA at the Site. Inspection logs will be in a checklist/fill-in-the blank-format. All inspection reports will include the date, time, and location of inspected item, weather conditions, and name of the individual conducting the inspection. An example of a typical inspection log is provided in Table 3-4. The log is formatted to ensure a specific itinerary is followed and that all

pertinent item/component identified is inspected. The log also includes a checklist of typical problems associated with each item/component to be inspected. A blank space is provided to record observations and comments/suggested corrective action. The inspection logs will be supplemented, as necessary, with written reports documenting failures/problems and mitigating actions taken.

The inspection logs will be completed for each of the specific areas or equipment listed in the inspection schedule and will be maintained in a permanent binder. Separate written reports documenting maintenance activities and remedial actions shall be recorded together with these logs. These inspection and maintenance logs are critical in providing a post-construction case history for the Site.

Preventive, non-emergency maintenance shall be completed as soon as practical to preclude further damage and minimize the need for emergency corrective action. If a hazard is determined to be imminent or has already occurred during the course of the inspection or any time between inspections, corrective actions shall be implemented immediately with notification to the appropriate authorities. An example of a typical preventive maintenance log is provided in Table 3-5.

A discussion of specific inspection and maintenance objectives for each item addressed in Tables 3-1 through 3-5 is presented in the following paragraphs.

## **3.6 SPECIFIC INSPECTION AND MAINTENANCE OBJECTIVES**

### **3.6.1 Subsurface Barrier Wall**

A network of ten pressure transducers was installed into ten existing monitoring wells in November 2015. Wells containing transducers include CAP-02, CAP-03, CAP-04, CAP-05, CAP-06, CAP-08, MW-04S, MW-08S, MW-01I and MW-01S. The purpose of the pressure transducers is to monitor for changes and trends in groundwater elevations both inside and outside the barrier wall, which can be used to help assess the integrity of the barrier wall and capping containment system at the Site. Maintenance of the transducers is anticipated approximately every six months; however, more frequent maintenance visits might be required if anomalous data is identified. Anticipated general maintenance includes checking the transducer batteries and replacing as necessary, inspecting the transducer, cables and cellular transmitter to ensure that they are functioning as expected and free from damage, collecting manual groundwater depth measurements to verify data recorded by the transducers and completing repairs as necessary.

### **3.6.2 Engineered Cap and Perimeter Drainage Ditches**

Field inspections should be made of the containment cell and capped area of the site on a quarterly basis for the first two years. Additionally, field inspections should be conducted within 72 hours of any major storm event (hurricanes, tornados, storm events producing > 2" rainfall per hour). If the capped area is found to be sound and free of damage during the first year, the frequency of inspections can be reduced to semi-annually. Annual inspections can be performed after three years of a well-established cover system.

Maintaining the integrity of the cover during the O&F period and confirming that the cap is functioning as designed is of key importance. Inspections of various components of the final cover are required to identify the need for maintenance. The following components of the overall capped areas should be inspected.

### 3.6.2.1 Cap Grading

Cap grading promotes controlled drainage by eliminating depressions or settlement. Some settlement is anticipated, but excessive or localized settlement could cause water to pond or concentrate runoff. Standing water could kill vegetation, causing cap instability, or could lead to significant erosion of the cover soil. Specific observations to be documented include:

- Presence and location of erosion gullies.
- Presence and location of settling (subsidence), uplift areas, depressions, or cracks.
- Presence and location of standing water.

### 3.6.2.2 Cover Vegetation.

Final cover vegetation prevents erosion of the final cover soils. Inadequate vegetation can allow erosion to occur in the barren area and on the down slopes. Vegetation loss can be caused by mowing too low, inadequate moisture, soil compaction, infertile soils, poor seed quality, standing water, or other causes. Specific observations to be documented include:

- Areas of sparse, dead, or missing vegetation.
- Stressed vegetation.
- Small rill erosion.
- Animal burrows/mounds.

Locations where deficiencies are observed should be recorded by a field sketch and placed in the field logs with reference (distance) to easily recoverable site features. Surface elevations should be determined by field survey in areas of localized subsidence or overall settlement, as necessary. Permanent site features may be used for horizontal control in documenting minor suspect areas, however a field survey is recommended to document any areas where significant differential movements have occurred. The O&M contractor should keep a photographic record of all site features and inspections.

Routine maintenance of grassed areas may include annual reseeding, as necessary, for those areas of sparse or stressed vegetation. As a minimum, the grass should be mowed down to 4 or 5 inches to promote growth of shallow rooted grass and to kill seedlet trees, shrubs, weeds or other pioneer species. Bare, sparsely covered and drought-damaged areas shall be reseeded no later than early September as the soil moisture content returns to normal levels. Soil testing, including hydrogen ion concentration (pH) measurements, may be performed every 3 years to determine fertilizer and lime requirements, if any. All required soil amendment additions will be completed before September 15 in a given year.

Routine maintenance activities related to the items identified above may include:

- Filling ruts and gullies in eroded berms/ conveyance ditches and re-grading fill and topsoil to match surrounding condition.
- Filling and grading areas of subsidence with fill material and topsoil to match existing surface grading.
- Removal of accumulated vegetation and debris from storm water conveyance ditches.

- Repair or replacement of fencing.
- Replacement of washed out or missing rip rap.

Localized subsidence or surface depressions (visual or evidenced by the presence of ponded water following a rain event) will require backfilling and re-grading to reestablish final grading and to ensure proper drainage, as discussed below

### 3.6.2.3 Cover Maintenance

Routine cover maintenance may include annual reseeding, as necessary. Soil testing, including pH measurements, may be required every year to determine fertilizer and lime requirements, if any. All required soil amendment additions will be completed during the active growing season for the vegetative cover. No chemical control for weeds or other evasive species of plant material is prescribed. If, based on recommendations from the O&M contractor, chemical controls are needed, a written request and authorization is required from the regulatory agencies prior to application. Appendix D contains a plant fact sheet on the vegetative cap cover, Argentine Bahia.

Localized subsidence or surface depressions (visual or evidenced by the presence of standing water following a rain event) will require backfilling and grading to reestablish final grading and to ensure proper drainage. The area should be brought to grade with clean, uncontaminated soil, using care not to disturb the underlying GCL. The top 6 inches of soil will be topsoil. Vegetative re-establishment may be necessary to repair areas of sparse, missing, or dead vegetation on the final cover, including areas that have been re-graded as follows:

- Evaluate the need for fertilization or soil amendment, and perform as necessary.
- Scarify the area, if necessary.
- Seed with the appropriate permanent seed mixture.
- Incorporate an additional temporary seed mixture, if necessary.
- Cover with temporary or permanent erosion control matting or mulch.

#### Repairs to Geocomposite Drainage Net (Geonet)

Repairs shall be made by placing a patch of the geosynthetic drainage layer over the damaged area. GSE Fabrinet 200 mil geocomposite, or equivalent, should be used. The patch shall extend a minimum of 2 ft beyond the edge of the damage. Approved fasteners, spaced every 6 inches around the patch, shall be used to hold the patch in place. Repairs shall be consistent with the technical specifications included as Appendix B.

#### Repairs to GCL

Holes or tears in the capping system GCL shall be repaired by placing a patch of GCL extending a minimum of 12 inches beyond the edges of the hole or tear on all sides. CETCO Lining Technology's Bentomat® ST, or equivalent, should be used. Granular bentonite or bentonite mastic shall be applied in the overlap area. Patches shall be secured with construction adhesive or other approved methods as recommended by the manufacturer. Repairs shall be consistent with the technical specifications included as Appendix B.

### 3.6.2.4 Erosion Prevention

Erosion could cause breaches in the cap system. Erosion can be caused by either water or wind. Erosion can be minimized by maintaining vegetative cover on soils and by providing protection in areas where storm water or wind flows tend to concentrate. Erosion prevention measures include:

- Inspect for erosion gullies, surface erosion, and vegetation stressed by surface-water flow; repair such problems as soon as possible to prevent progressive erosive degradation of cover integrity.
- Inspect for areas of unexpected concentrations of surface water flow and manage flow in such areas to prevent excessive scour or erosion of the cover system.
- Inspect along toes of slopes to see if there is any evidence of impending erosion; repair any problems and evaluate design alternative that could prevent such problems in the future.
- Inspect edges of the cap where wind concentrates to see if there is evidence of wind erosion. Repair erosion problems by evaluating design alternatives to prevent the concentration of wind forces.

### 3.6.2.5 Animal Intrusions

Animal intrusions can cause holes in the cover, which can cause damage to the cover system. Animal intrusion is typically a problem by burrowing animals. Intrusions can be prevented by installing barriers, rocks or cobbles. Animal intrusion prevention guidelines include:

- Check for evidence of animal traffic on cover (e.g. tracks, trails, droppings). If such evidence exists and the animals are of a type that could damage the integrity of the cover, consider ICs to prevent animal access to the cover areas.
- Check for animal holes in the capped area which could be a conduit for liquid migration. Fill holes as needed and consider the need for features that prevent animal intrusion.
- When evaluating the cause of seeps consider the possibility that the seeps could be caused by animal intrusion.
- Recognize that if there is one animal intrusion hole, there may likely be many such holes. A more comprehensive survey should be completed for additional holes.
- Fill animal intrusion holes as soon as possible to discourage population increase.

### 3.6.2.6 Settlement

Excessive settlement or subsidence can cause damage to the cover, which can result in a variety of problems. Problems caused by excessive settlement include (a) standing water on the cover, which can lead to increased infiltration, buildup of water, instability; and (b) cracking of the cover, which can lead to increased erosion or infiltration into the cap and resulting instability. Settlement controls include:

- Perform periodic surveys to evaluate settlement of the cap.
- If settlement is affecting the performance of the storm water runoff, consider reestablishing grades to promote positive drainage.

### 3.6.3 Groundwater Monitoring System

Groundwater monitoring at the site is intended to serve two functions: to assess the effectiveness of the ISCO remedy in the intermediate groundwater aquifer and to assess how the combination of remedies installed at the Site is impacting groundwater in the vicinity of the Site in both the shallow and intermediate aquifers. The ISCO performance monitoring will be implemented semi-annually for the first two years. After two years, the sampling program may be modified as necessary. The groundwater remedy will be considered complete when sampling confirms that there is no contamination above groundwater remedial goals (listed in Table 2-1) in site monitoring wells for two consecutive years.

Annual monitoring of the shallow and intermediate groundwater wells across the Site will be performed for at least 5 years. After 5 years, the overall effectiveness of the remedy should be evaluated and the annual monitoring may be adjusted accordingly. Table 2-3 lists the frequency and parameters for each well.

At each monitoring event, the groundwater levels in the monitoring wells will be measured, recorded, and evaluated to verify the water is below the base of the cell. In addition, the following parameters will be recorded in the field: ferrous iron, dissolved oxygen (DO), oxidation-reduction potential (ORP) and pH. Sampling procedures should follow the approved Quality Assurance Project Plan (QAPP), Revision 2.0, July 2017, current EPA procedures as provided in the Quality System and Technical Procedures for Science and Ecosystem Support Division (SESD) Field Branches (<https://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches>) and Table 2-3 of this O&M plan.

In addition to water level measurements, monitoring wells shall be maintained so that they are clearly visible to maintenance crews and their subcontractors. Requirements include:

- Trimming the grass around the wells using a string trimming device in late spring and fall.
- Maintenance of the high visibility paint on the wells' protective casings on an as-needed basis. If wells are repainted, the well identification number must be clearly labeled after repainting.
- Assuring that the wells' security locks are in place.
- Assuring that the concrete well pads are in good condition, in particular, those in roadways and walkways.

### 3.6.4 Concrete Foundations

Significant issues with the foundations are not anticipated; however, the concrete and sonotubes should be visually inspected annually for cracks, movement, spalling, or other obvious defects. Record locations of all major defects and the magnitude of observed defects. Repairs to defects should be made as necessary. After rainfall events, check sonotubes for standing water and drain if necessary

### 3.6.5 Site Security

The integrity of all fencing should be inspected at least monthly during the post-construction monitoring period. The outer aluminum casings over the monitoring wells will also be locked. Agency personnel will have codes and keys to all the security locks. During each site visit, the O&M inspection will check for:

- Missing locks, hinges, etc. from gates.
- Integrity of monitoring wells.

- Vehicle tracks.
- Foot traffic tracks.
- Cans, bottles or other trash.
- Other signs of unauthorized access or vandalism.

### **3.7 ENFORCEMENT OF DEED/CONSTRUCTION RESTRICTIONS**

The restrictive covenant will state that no one shall dig into, excavate, or otherwise disturb the containment cell and the 3 ft of clean soil capping the containment cells, without first notifying and obtaining approval from EPA and GAEPD. The O&M inspection shall make observations of all intrusive activities over the capped areas. Any damage to the cap systems or monitoring wells shall be repaired in a timely manner by the inspecting agency.

### **3.8 COST ESTIMATE**

A summary of the estimated costs for periodic site inspections, water level measurements and reporting, and routine maintenance for 30 years is presented in Table 3-5 (note that cost estimates for Superfund sites are typically based on a 30-year period, although O&M costs will continue beyond 30 years). The cost estimates were based on the following assumptions:

- Local resources will be employed for maintenance.
- The base year's fully loaded labor rate for the site inspector is \$100 per hour.
- An inflation rate of 5 percent annually over the 30-year period will persist.
- The EPA will be conducting the groundwater sampling, analysis, and transducer maintenance efforts.

## 4.0 References

Black & Veatch, 2011. Black & Veatch Special Project Corp., *100% Remedial Design Basis of Design Report, Camilla Wood Preserving Site*. March 2011

Black & Veatch, 2015. Black & Veatch Special Project Corp., *Remedial Action Report for the Camilla Wood Preserving Site*. July 31, 2015

EPA, 2009. U.S. Environmental Protection Agency, *Camilla Wood Preserving Site Record of Decision*. September 2009

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## Tables

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**Table 2-1**  
**Groundwater Remedial Goal Summary**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Chemical of Concern	Remedial Goal (ppb)	Basis
<b>Shallow Groundwater</b>		
Benzene	5	MCL
2,4-Dimethylphenol	313	Child Resident
2-Methylnaphthalene	31	Child Resident
cPAHs BaP	0.2	MCL
Carbazole	48	Lifetime Resident
Dibenzofuran	31	Child Resident
Naphthalene	156	Child Resident
Pentachlorophenol	1	MCL
Phenanthrene	469	Child Resident
Arsenic	10	MCL
Manganese	300	Lifetime Health Advisory
<b>Intermediate Groundwater</b>		
Benzene	5	MCL
Ethylbenzene	700	MCL
2-Methylnaphthalene	31	Child Resident
Acenaphthene	469	Child Resident
cPAHs BaP	0.2	MCL
Carbazole	48	Lifetime Resident
Dibenzofuran	31	Child Resident
Flouroene	313	Child Resident
Naphthalene	156	Child Resident
Pentachlorophenol	1	MCL
Phenanthrene	469	Child Resident
Heptachlor Epoxide	0.2	MCL
Arsenic	10	MCL
Manganese	300	Lifetime Health Advisory
Nickel	313	Child Resident

**Notes:**

BaP - Benzo(a)pyrene equivalent

cPAH - Carcinogenic Polynuclear Aromatic Hydrocarbon

MCL - Maximum Contaminant Level

ppb - parts per billion

RGO - remedial goal objective

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**Table 2-2**  
**Well Construction Details**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID	Date	Depth (ft bls)	Screened Interval (ft bls)	Casing Elevation	Depth to Water at Time of Drilling (ft BTOC)	Screen Material	Aquifer	Easting	Northing	Notes
AFMW-01I	3/3/2003	165	145-165	179.47	44.1	2-in SS	Intermediate	2286078.691	444237.666	Athletic field, downgradient sentinel well, ISCO performance well
AFMW-02I	3/13/2004	91	81.0-90.6	175.64	47.83	2-in SS	Intermediate	2285967.004	444710.913	Athletic field, downgradient sentinel well, ISCO performance well
AFMW-03I	12/14/2006	97	81.0-90.6	176.73	NR	2-in SS	Intermediate	2285959.529	444532.816	Athletic field, downgradient sentinel well, ISCO performance well
AFMW-04D	2/11/2013	349	279-349	181.78	NR	2-in SS	Intermediate	2286329.516	444666.683	Athletic field, downgradient sentinel well, ISCO performance well
AFMW-05I	9/12/2013	146	136-146	177.32	53.00	2-in SS	Intermediate	2285967.200	444550.900	Athletic field, downgradient sentinel well, ISCO performance well
AFMW-06I	9/26/2013	170	160-170	178.17	51.00	2-in SS	Intermediate	2285964.250	444411.300	Athletic field, downgradient sentinel well, ISCO performance well
AFMW-07I	7/8/2014	90	80-90	178.17	NR	2-in SS	Intermediate	2285971.021	444381.689	Athletic field, downgradient sentinel well, ISCO performance well
AFMW-08I	7/9/2014	121	111-121	181.23	NR	2-in SS	Intermediate	2286332.667	444653.113	Athletic field, downgradient sentinel well, ISCO performance well
CAP-01	-	-	-	169.70	-	2-in-PVC	Shallow	2285368.280	444817.385	Barrier wall groundwater elevation monitoring, not used
CAP-02	11/20/2015	19.4	9-4-19.4	171.65	4.61	2-in-PVC	Shallow	2285610.200	444439.610	Barrier wall groundwater elevation monitoring, transducer installed
CAP-03	11/20/2015	18.93	8.93-18.93	168.31	2.72	2-in-PVC	Shallow	2285057.280	444050.190	Barrier wall groundwater elevation monitoring, transducer installed
CAP-04	11/20/2015	25.8	15.8-25.8	175.76	15.85	2-in-PVC	Shallow	2285585.950	444440.200	Barrier wall groundwater elevation monitoring, transducer installed
CAP-05	11/20/2015	25.38	15.38-25.38	176.22	18.82	2-in-PVC	Shallow	2285557.320	444169.900	Barrier wall groundwater elevation monitoring, transducer installed
CAP-06	11/20/2015	24.34	14.34-24.34	175.06	18.69	2-in-PVC	Shallow	2285064.410	444100.130	Barrier wall groundwater elevation monitoring, transducer installed
CAP-08	11/20/2015	25.53	15.53-25.25	175.58	16.25	2-in-PVC	Shallow	2285052.420	444768.340	Barrier wall groundwater elevation monitoring, transducer installed
CMW-01I	5/29/1997	120	110.0-120.0	172.15	44.91	2-in PVC	Intermediate	2285714.001	444455.375	ISCO performance monitoring well
CMW-01S	5/29/1997	20	10.0-20.0	172.15	5.88	2-in PVC	Shallow	2285715.509	444499.593	Barrier wall/excavation performance monitoring well
EW01	2/25/2014	95	80-95	172.08	NR	4-in SS	Intermediate	2285764.345	444439.501	ISCO extraction well
EW02	7/26/2014	111	81-111	172.30	NR	4-in SS	Intermediate	2285731.222	444367.615	ISCO extraction well
F15MWI	2/28/2003	79	69-79	169.68	50.34	2-in SS	Intermediate	2284507.861	444545.587	Barrier wall performance monitoring well
IW01-A	7/8/2014	85	66-81	171.71	NR	2-in SS	Intermediate	2285766.596	444497.269	ISCO injection well
IW02-A	7/14/2014	85	69-84	171.94	NR	2-in SS	Intermediate	2285807.560	444497.296	ISCO injection well
IW03-B	7/11/2014	95	83-93	171.56	NR	2-in SS	Intermediate	2285747.651	444461.175	ISCO injection well
IW04-A	7/10/2014	90	83-93	171.79	NR	2-in SS	Intermediate	2285782.699	444461.225	ISCO injection well
IW04-B	7/14/2014	75	63-73	171.95	NR	2-in SS	Intermediate	2285788.361	444461.042	ISCO injection well
IW05-A	8/5/2014	86	68-83	172.23	NR	2-in SS	Intermediate	2285812.724	444469.986	ISCO injection well
IW06-A	7/21/2014	80	69-79	171.29	NR	2-in SS	Intermediate	2285684.439	444424.964	ISCO injection well
IW06-B	7/23/2014	106	89-104	171.18	NR	2-in SS	Intermediate	2285691.614	444428.054	ISCO injection well
IW07-A	7/23/2014	86	69-84	171.64	NR	2-in SS	Intermediate	2285718.979	444414.062	ISCO injection well
IW07-B	7/12/2014	105	89-104	171.76	NR	2-in SS	Intermediate	2285726.417	444411.100	ISCO injection well
IW08-A	7/13/2014	80	63-78	172.10	NR	2-in SS	Intermediate	2285775.079	444423.746	ISCO injection well
IW08-B	7/13/2014	100	83-98	172.10	NR	2-in SS	Intermediate	2285770.125	444423.688	ISCO injection well
IW09-A	7/23/2014	80	64-79	172.48	NR	2-in SS	Intermediate	2285806.664	444422.943	ISCO injection well
IW09-B	7/22/2014	101	83-98	172.81	NR	2-in SS	Intermediate	2285811.871	444424.700	ISCO injection well
IW10-A	8/6/2014	85	69-84	172.78	NR	2-in SS	Intermediate	2285813.482	444399.061	ISCO injection well

**Table 2-2  
Well Construction Details  
Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia**

Well ID	Date	Depth (ft bls)	Screened Interval (ft bls)	Casing Elevation	Depth to Water at Time of Drilling (ft BTOC)	Screen Material	Aquifer	Easting	Northing	Notes
IW11-A	7/13/2014	80	70-80	171.68	NR	2-in SS	Intermediate	2285683.906	444379.764	ISCO injection well
IW11-B	7/13/2014	104	89-104	171.65	NR	2-in SS	Intermediate	2285683.603	444385.843	ISCO injection well
IW12-A	7/27/2014	75	65-75	171.71	NR	2-in SS	Intermediate	2285707.113	444382.692	ISCO injection well
IW12-B	7/25/2014	90	79-89	171.68	NR	2-in SS	Intermediate	2285700.317	444391.408	ISCO injection well
IW12-C	7/24/2014	110	95-110	171.83	NR	2-in SS	Intermediate	2285712.235	444392.218	ISCO injection well
IW13-A	7/26/2014	75	65-75	172.26	NR	2-in SS	Intermediate	2285746.967	444389.887	ISCO injection well
IW13-B	7/23/2014	91	79-89	172.29	NR	2-in SS	Intermediate	2285750.536	444397.299	ISCO injection well
IW13-C	7/22/2014	111	94-109	172.23	NR	2-in SS	Intermediate	2285745.192	444396.751	ISCO injection well
IW15-A	7/13/2014	80	63-78	172.79	NR	2-in SS	Intermediate	2285801.129	444381.185	ISCO injection well
IW15-B	7/13/2014	100	83-98	172.84	NR	2-in SS	Intermediate	2285805.670	444380.773	ISCO injection well
IW16-A	8/7/2014	90	75-90	173.88	NR	2-in SS	Intermediate	2285816.885	444325.625	ISCO injection well
IW17-A	8/9/2014	86	70-85	171.71	NR	2-in SS	Intermediate	2285684.346	444342.157	ISCO injection well
IW17-B	8/9/2014	104	89-104	172.69	NR	2-in SS	Intermediate	2285689.723	444342.646	ISCO injection well
IW18-A	8/9/2014	85	69-84	172.15	NR	2-in SS	Intermediate	2285726.436	444338.418	ISCO injection well
IW18-B	8/9/2014	110	94-109	172.16	NR	2-in SS	Intermediate	2285720.017	444338.010	ISCO injection well
IW19-A	8/10/2014	81	66-81	173.09	NR	2-in SS	Intermediate	2285747.687	444347.805	ISCO injection well
IW19-B	8/9/2014	105	90-105	172.82	NR	2-in SS	Intermediate	2285747.670	444343.504	ISCO injection well
IW20-A	7/10/2014	80	69-79	173.23	NR	2-in SS	Intermediate	2285802.275	444343.105	ISCO injection well
IW20-B	7/11/2014	100	83-98	173.28	NR	2-in SS	Intermediate	2285807.456	444343.034	ISCO injection well
IW21-A	8/8/2014	90	74-89	173.55	NR	2-in SS	Intermediate	2285788.805	444294.866	ISCO injection well
IW22-A	7/27/2014	101	90-100	172.57	NR	2-in SS	Intermediate	2285749.852	444301.242	ISCO injection well
LMW-01I	2/25/2003	59	49-59	169.77	43.0	2-in stainless	Intermediate	2284941.675	444966.786	Downgradient monitoring well (Lincoln Street)
MASMW-01I	12/8/2006	137	116.0-136.0	180.19	NR	2-in SS	Intermediate	2286321.809	443832.983	Downgradient monitoring well
MASMW-02I	12/12/2006	97	81.0-90.6	178.79	NR	2-in SS	Intermediate	2286075.348	443816.875	Downgradient monitoring well
MW-01A	Unknown	40.28*	Unknown	171.28	Unknown	6-in PVC	Intermediate	2285710.185	444696.567	Barrier wall/excavation performance monitoring well
MW-01I	5/14/1997	67	55.0-67.0	168.9	42.36	2-in PVC	Intermediate	2284787.053	444631.566	Groundwater monitoring well, transducer installed
MW-01S	5/19/1997	20	9.0-20.0	168.82	5.3	2-in PVC	Shallow	2284817.892	444636.045	Groundwater monitoring well, transducer installed
MW-02	Unknown	80.5	60.0-80.5	169.92	47.99	3-in steel	Intermediate	2285608.833	444162.715	Closed, replaced by MW29I
MW-02I	5/16/1997	65	55.0-65.0	169.55	43.01	2-in PVC	Intermediate	2284920.009	444367.728	Barrier wall performance monitoring well
MW-02S	5/19/1997	20	9.0-20.0	169.61	5.67	2-in PVC	Shallow	2284922.149	444360.999	Barrier wall performance monitoring well
MW-03A	Unknown	92*	Unknown	178.62	102.02	4-in PVC	Intermediate	2285111.980	444635.883	Inside barrier wall, intermediate aquifer monitoring well
MW-03B	Unknown	56.3*	Unknown	169.32	101.5	4-in PVC	Intermediate	2284973.359	444680.868	Barrier wall performance monitoring well
MW-03I	5/18/1997	100	90.0-100.0	179.16	43.92	2-in PVC	Intermediate	2285207.028	444226.605	Inside barrier wall, intermediate aquifer monitoring well
MW-03S	Unknown	22.24*	Unknown	179.31	99.61	2-in PVC	Shallow	2285211.976	444234.578	Inside barrier wall, assessment well only

**Table 2-2  
Well Construction Details  
Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia**

Well ID	Date	Depth (ft bls)	Screened Interval (ft bls)	Casing Elevation	Depth to Water at Time of Drilling (ft BTOC)	Screen Material	Aquifer	Easting	Northing	Notes
MW-04A	Unknown	74*	Unknown	170.56	Unknown	4-in PVC	Intermediate	444799.740	2285034.390	Barrier wall performance monitoring well
MW-04S	5/15/1997	15	5.0-15.0	170.13	4.36	2-in PVC	Shallow	2285602.486	444160.997	Groundwater monitoring well, transducer installed
MW-05I	5/21/1997	75	65.0-75.0	175.23	44.44	2-in PVC	Intermediate	2285571.073	444557.910	Inside barrier wall, intermediate aquifer monitoring well
MW-05S	5/21/1997	20	10.0-20.0	175.62	16.8	2-in PVC	Shallow	2285571.230	444563.601	Inside barrier wall, assessment well only
MW-06I	5/18/1997	175	165.0-175.0	175.62	43.59	2-in PVC	Intermediate	2285565.459	444790.728	Inside barrier wall, intermediate aquifer monitoring well
MW-06S	5/19/1997	20	8.0-20.0	175.89	5.37	2-in PVC	Shallow	2285556.872	444780.835	Inside barrier wall, assessment well only
MW-07I	5/20/1997	110	100.0-110.0	176.22	43.33	2-in PVC	Intermediate	2285360.861	444792.507	Inside barrier wall, intermediate aquifer monitoring well
MW-07S	5/21/1997	20	10.0-20.0	176.21	5.15	2-in PVC	Shallow	2285371.384	444792.803	Inside barrier wall, assessment well only
MW-08S	5/14/1997	16	6.0-16.0	170.02	2.93	2-in PVC	Shallow	2285047.342	444794.061	Groundwater monitoring well, transducer installed
MW09I	12/7/2006	67	56.0-66.0	178.57	NR	2-in SS	Intermediate	2285422.866	444184.077	Inside barrier wall, intermediate aquifer monitoring well
MW10I	12/11/2006	76	65.0-75.0	174.87	NR	2-in SS	Intermediate	2285588.450	444382.990	Closed, replaced by MW32D
MW-11I	4/17/2010	75	64.83-74.83	172.25	NR	2-in SS	Intermediate	2285682.046	444357.450	ISCO performance monitoring well
MW-11S	4/17/2010	25	14.95-24.80	171.75	NR	2-in SS	Shallow	2285676.395	444403.708	Barrier wall/excavation performance monitoring well
MW-12S	4/16/2010	25	14.95-24.80	172.89	NR	2-in SS	Shallow	2285833.703	444428.892	Barrier wall/excavation performance monitoring well
MW-13S	4/15/2010	25	14.95-24.80	171.14	NR	2-in SS	Shallow	2285704.174	444694.709	Barrier wall/excavation performance monitoring well
MW-14S	4/16/2010	25	14.95-24.80	170.42	NR	2-in SS	Shallow	2285597.936	444881.647	Barrier wall/excavation performance monitoring well
MW-15I	4/14/2010	75	64.83-74.83	174.69	NR	2-in SS	Intermediate	2285388.960	444516.305	Inside barrier wall, intermediate aquifer monitoring well
MW-16I	4/13/2010	105	94.83-104.83	179.2	NR	2-in SS	Intermediate	2285459.478	444359.002	Inside barrier wall, intermediate aquifer monitoring well
MW-17I	4/13/2010	85	74.83-84.83	177.89	NR	2-in SS	Intermediate	2285539.402	444284.597	Inside barrier wall, intermediate aquifer monitoring well
MW-18I	4/16/2010	85	74.83-84.83	173.98	NR	2-in SS	Intermediate	2285830.336	444352.038	ISCO performance monitoring well
MW-19I	4/22/2010	75	64.83-74.83	174.21	NR	2-in SS	Intermediate	2285728.168	444091.878	Barrier wall performance monitoring well
MW-20I	4/15/2010	75	64.83-74.83	167.24	NR	2-in SS	Intermediate	2284818.230	443449.814	Downgradient monitoring well
MW-21I	4/21/2010	105	94.83-104.83	175.8	NR	2-in SS	Intermediate	2285015.221	443317.603	Downgradient monitoring well
MW-22S	4/22/2010	25	14.83-24.83	171.53	NR	2-in SS	Shallow	2285394.548	444327.751	Inside barrier wall, assessment well only
MW23I	12/5/2011	87	77-87	180.34	NR	2-in SS	Intermediate	2285219.817	444358.268	Inside barrier wall, intermediate aquifer monitoring well
MW-26A	10/3/2012	69	64-69	172.15	NR	2-in SS	Intermediate	2285734.985	444397.363	ISCO performance monitoring well
MW-26B	10/3/2012	81	71-81	172.10	NR	2-in SS	Intermediate	2285731.613	444393.954	ISCO performance monitoring well
MW-26C	10/2/2012	92	82-92	172.30	NR	2-in SS	Intermediate	2285739.267	444394.456	ISCO performance monitoring well
MW-26D	10/2/2012	105	95-105	172.30	60.50	2-in SS	Intermediate	2285735.389	444390.102	ISCO performance monitoring well
MW-27I	10/11/2012	156	146-156	167.63	NR	2-in SS	Intermediate	2284691.949	443424.225	Downgradient monitoring well, replaced MWPBCI
MW-28I	10/10/2012	85	75-85	167.79	NR	2-in SS	Intermediate	2284961.110	443434.305	Downgradient monitoring well, replaced MWPBEI
MW-29I	10/10/2012	74	64-74	170.13	NR	2-in SS	Intermediate	2285603.164	444160.844	Barrier wall performance monitoring well, replaced MW-02
MW-30D	1/17/2013	137	127-137	172.13	NR	2-in SS	Intermediate	2285733.980	444404.350	ISCO performance monitoring well
MW-31I	1/20/2013	97	87-97	175.12	NR	2-in SS	Intermediate	2285792.265	444471.713	ISCO performance monitoring well

**Table 2-2  
Well Construction Details  
Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia**

Well ID	Date	Depth (ft bls)	Screened Interval (ft bls)	Casing Elevation	Depth to Water at Time of Drilling (ft BTOC)	Screen Material	Aquifer	Easting	Northing	Notes
MW-32D	1/29/2013	147	137-147	171.79	NR	2-in SS	Intermediate	2285592.411	444357.202	Inside barrier wall, intermediate aquifer monitoring well, replaced MW10I
MW-33D	2/1/2013	147	137-147	173.63	NR	2-in SS	Intermediate	2285816.163	444348.385	Well obstructed, unable to be cleared
MW-34D*	9/16/2013	151	141-151	174.23	50.50	2-in SS	Intermediate	2285835.120	444261.200	ISCO performance monitoring well
MW-35D	2/27/2014	95	80-95	172.43	NR	2-in SS	Intermediate	2285764.212	444423.912	ISCO performance monitoring well
MW-36D	2/26/2014	95	80-95	172.13	NR	2-in SS	Intermediate	2285789.666	444437.988	ISCO performance monitoring well
MW-37	7/9/2014	85	66-81	171.75	NR	2-in SS	Intermediate	2285767.330	444470.541	ISCO performance monitoring well
MW-38A	7/15/2014	85	70-85	171.68	NR	2-in SS	Intermediate	2285712.660	444444.745	ISCO performance monitoring well
MW-38B	7/22/2014	105	87-102	171.27	NR	2-in SS	Intermediate	2285703.224	444437.285	ISCO performance monitoring well
MW-39A	7/14/2014	80	64-79	172.31	NR	2-in SS	Intermediate	2285788.305	444407.920	ISCO performance monitoring well
MW-39B	7/14/2014	100	84-99	172.30	NR	2-in SS	Intermediate	2285792.738	444413.433	ISCO performance monitoring well
MW-40	7/12/2014	105	94-104	173.14	NR	2-in SS	Intermediate	2285812.743	444368.521	ISCO performance monitoring well
MW-41	7/24/2014	85.5	74-84	171.52	NR	2-in SS	Intermediate	2285742.292	444518.118	ISCO performance monitoring well
MWPBCI	Unknown	200	Unknown	NR	50	Unknown	Intermediate	2284694.200	443433.440	Closed, replaced by MW27I
MWPBEI	Unknown	66	Unknown	NR	45.68	4-in steel	Intermediate	2284959.650	443438.400	Closed, replaced by MW28I
MWPBWI	Unknown	61.5	Unknown	NR	45.02	4-in steel	Intermediate	2284350.240	443510.680	Closed, not replaced
PWM-01I	3/14/2004	71	61.4-71.0	172.78	45.03	2-in SS	Intermediate	2285706.267	444178.346	Barrier wall performance monitoring well (Powell Street)
SMW-01I	2/26/2003	129	119-129	169.77	26.5	2-in SS	Intermediate	2285337.580	444874.578	Downgradient monitoring well (Singleton Street)
SMW-01S	3/1/2003	18	8-18	173.53	NR	2-in SS	Shallow	2285331.240	444943.900	Barrier wall performance monitoring well (Singleton Street)
SMW-02I	3/16/2004	96	86.4-96.0	171.51	40.13	2-in SS	Intermediate	2285329.877	444950.538	Downgradient monitoring well (Singleton Street)
SMW-03I	3/9/2004	81	71.43-81.0	183.1	44.29	2-in SS	Intermediate	2285350.480	445320.810	Downgradient monitoring well (Singleton Street)
TMW-01I	3/2/2003	109	99-109	170.74	47.63	2-in SS	Intermediate	2285633.876	445031.067	Downgradient monitoring well (Thomas Street)
TMW-02I	12/8/2006	97	76.0-96.0	172.87	NR	2-in SS	Intermediate	2285835.040	443382.820	Downgradient monitoring well (Thomas Street)

**Notes:**

- bls Below land surface
- BTOC Below top of casing
- ft feet
- in inch
- NR Not recorded
- PVC Polyvinyl chloride
- SS Stainless Steel
- \* Total well depth below top of casing

**Table 2-3**  
**Recommended Groundwater Monitoring Program**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID	Easting	Northing	Total Well Depth (ft)	Monitoring Frequency and Analyses		
				Semi-Annual SVOC	Semi-Annual TAL Metals	Annual VOCs, SVOC and Metals
AFMW-01I	2286078.69	444237.67	165	X <sup>1</sup>		X <sup>1</sup>
AFMW-02I	2285967.00	444710.91	91	X <sup>1</sup>		X <sup>1</sup>
AFMW-03I	2285959.53	444532.82	97	X <sup>1</sup>		X <sup>1</sup>
AFMW-04D	2286329.52	444666.68	349	X <sup>1</sup>		X <sup>1</sup>
AFMW-05I	2285967.20	444550.90	146	X <sup>1</sup>	X	X <sup>1</sup>
AFMW-06I	2285964.25	444411.30	170	X <sup>1</sup>	X	X <sup>1</sup>
AFMW-07I	2285971.02	444381.69	90	X <sup>1</sup>		X <sup>1</sup>
AFMW-08I	2286332.67	444653.11	121	X <sup>1</sup>		X <sup>1</sup>
CMW-01I	2285714.00	444455.38	120	X <sup>1</sup>		X <sup>1</sup>
CMW-01S	2285715.51	444499.59	20			X
F15MWI	2284507.86	444545.59	79			X <sup>1</sup>
LMW-01I	2284941.675	444966.79	59			X <sup>1</sup>
MASMW-01I	2286321.81	443832.98	137			X <sup>1</sup>
MASMW-02I	2286075.35	443816.88	97			X <sup>1</sup>
MW-01A	2285710.19	444696.57	40.28			X
MW-01I	2284787.05	444631.57	67			X <sup>1</sup>
MW-01S	2284817.89	444636.05	20			X <sup>1</sup>
MW-02I	2284920.01	444367.73	65			X <sup>1</sup>
MW-02S	2284922.15	444361.00	20			X <sup>1</sup>
MW-03A	2285111.98	444635.88	92			X <sup>1</sup>
MW-03B	2284973.36	444680.87	56.3			X <sup>1</sup>
MW-03I	2285207.03	444226.61	100			X <sup>1</sup>
MW-04A	444799.74	2285034.39	74			X <sup>1</sup>
MW-04S	2285602.49	444161.00	15			X
MW-05I	2285571.07	444557.91	75			X
MW-06I	2285565.46	444790.73	175			X <sup>1</sup>
MW-07I	2285360.86	444792.51	110			X <sup>1</sup>
MW-08S	2285047.34	444794.06	16			X <sup>1</sup>
MW09I	2285422.87	444184.08	67			X <sup>1</sup>
MW-11I	2285676.40	444403.71	25	X		X
MW-11S	2285833.70	444428.89	25			X
MW-12S	2285704.17	444694.71	25			X
MW-13S	2285597.94	444881.65	25			X
MW-14S	2285597.94	444881.65	25			X
MW-15I	2285388.96	444516.31	105			X <sup>1</sup>
MW-16I	2285459.48	444359.00	105			X <sup>1</sup>
MW-17I	2285539.40	444284.60	85			X <sup>1</sup>
MW-18I	2285830.34	444352.04	85	X		X
MW-19I	2285728.17	444091.88	75			X <sup>1</sup>
MW-20I	2284818.23	443449.81	75			X <sup>1</sup>
MW-21I	2285015.22	443317.60	105			X <sup>1</sup>
MW-23I	2285219.82	444358.27	87			X <sup>1</sup>
MW-26A	2285734.99	444397.36	69	X		X
MW-26B	2285731.61	444393.95	81	X		X
MW-26C	2285739.27	444394.46	92	X		X
MW-26D	2285735.39	444390.10	105	X		X
MW-27I	2284691.95	443424.23	156			X
MW-28I	2284961.11	443434.31	85			X

**Table 2-3**  
**Recommended Groundwater Monitoring Program**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID	Easting	Northing	Total Well Depth (ft)	Monitoring Frequency and Analyses		
				Semi-Annual SVOC	Semi-Annual TAL Metals	Annual VOCs, SVOC and Metals
MW-29I	2285603.16	444160.84	74			X
MW-30D	2285733.98	444404.35	137	X		X
MW-31I	2285792.26	444471.71	97	X		X
MW-32D	2285592.41	444357.20	147			X
MW-34D	2285835.12	444261.20	151	X		X
MW-35D	2285764.21	444423.91	95	X		X
MW-36D	2285789.67	444437.99	95	X		X
MW-37	2285767.33	444470.54	85	X	X	X
MW-38A	2285712.66	444444.74	85	X		X
MW-38B	2285703.22	444437.29	105	X		X
MW-39A	2285788.30	444407.92	80	X		X
MW-39B	2285792.74	444413.43	100	X		X
MW-40	2285812.74	444368.52	105	X	X	X
MW-41	2285742.29	444518.12	85.5	X	X	X
PMW-01I	2285706.27	444178.35	71			X
SMW-01I	2285337.58	444874.58	129			X
SMW-01S	2285331.24	444943.90	18			X <sup>1</sup>
SMW-02I	2285329.88	444950.54	96			X <sup>1</sup>
SMW-03I	2285350.48	445320.81	81			X <sup>1</sup>
TMW-01I	2285633.88	445031.07	109			X <sup>1</sup>
TMW-02I	2285835.04	443382.82	97			X <sup>1</sup>
Number of Sample Locations				27	5	69
Samples Requiring SIM Analysis				9	0	37

**Notes:**

Shallow monitoring well

ft - feet

1 -Select ion monitoring (SIM) analysis should be run for Polynuclear Aromatic Hydrocarbons (PAHs) and Pentachlorophenol (PCP)

SVOC - Semi-volatile Organic Compounds

VOC - Volatile Organic Compounds

TAL - Target Analyte List, includes 23 metals

SVOCs will be analyzed for by EPA Method 8270D

VOCs will be analyzed for by EPA Method 8260D

TAL Metals will be analyzed for by EPA Method 6010

**Table 3-1  
Schedule of Inspections  
Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia**

Specific Item	Typical Problems	Minimum Suggested Frequency				Notes
		Monthly	Semi-annually	Annually	After Major Storms	
Final Cover	Erosion		X		X	Written report will be made if problems are observed/ encountered.
	Vegetation stress		X		X	
	Settling/Ponding of Water		X		X	
	Uplift		X		X	
	Washouts		X		X	
	Animal Burrows		X			
	Slope Instability		X			
	Rock Drainage Ring		X			
	Rip Rap Drainage Channels		X			
	Evidence of Leakage Around Penetrations		X			
	Scouring		X		X	
Monitoring Wells	High Water Table			X		Written report will be made if problems are observed/ encountered.
	Missing Locks, Damaged Casing, Damage to Pad			X		
	Routine monitoring			X		Written annual report will summarize analytical data.
Barrier Wall	Rising Groundwater Levels	X				Data from transducer array to be analyzed on a monthly basis. Written semi-annual report will summarize transducer data and identify rising groundwater level trends.
	Evidence of Settling		X			
	Routine Maintenance of Transducer Array		X			
Perimeter Stormwater Ditches	Trash, Vegetation, Sedimentation			X	X	Written report will be made if problems are observed/ encountered.
Concrete Foundations	Spalling/Cracking			X		Written report will be made if problems are observed/encountered
	Ponding Water			X		
	Settlement			X		
Site Security	Trespassing / Vandalism	X				Written report will be made if problems are observed/ encountered.
Enforcement of Deed / Construction Restrictions	Unapproved Land Use			X		Written report will be made if problems are observed/ encountered.

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**Table 3-2**  
**Schedule of Preventive (Routine) Maintenance**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Specific Item	Typical Problems	Minimum Suggested Frequency					Notes
		Quarterly	Semi-annually	Annually	After Major Storms	File Report <sup>1</sup>	
Final Cover	Mowing	X					Frequency depends on visual observation / as-needed basis.
	Regrading / Backfilling			X	X	X	
Barrier Wall	Transducer Maintenance		X				Frequency depends on proper functioning of units and as-needed.
Perimeter Stormwater Ditches	Trash, Vegetation, Sedimentation			X	X	X	Clean out ditches as necessary to maintain overland flow.
Concrete Foundations	Spalling/Cracking, Settlement			X		X	Frequency depends on visual observation / as-needed basis.

**Notes:**

1. File report at completion of maintenance activity.

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**Table 3-3**  
**O Inspection Items Frequency and Responsibility**  
**Camilla Wood Preservng Site**  
**Camilla, Mitchell County, Georgia**

Inspection Item	Frequency	Responsible Party*
Maintain the integrity of the final cover, including making necessary repairs to the cover components, to correct the effects of settling, subsidence, erosion or other events	After major storm events, semi-annually	GAEPD
Monitoring the effectiveness of the cover system	Annually	GAEPD
Monitoring the effectiveness of the low permeability barrier wall	Semi-annually	GAEPD
Preventing surface water run-on and runoff from eroding or otherwise damaging the cap	After major storm events, semi-annually	GAEPD
Ensuring that the security of the monitoring wells is maintained	Annually	GAEPD
Ensuring the engineering controls and institutional controls are being enforced	Annually	GAEPD
Perimeter storm water ditches	After major storm events, annually	GAEPD
Concrete foundations	Annually	GAEPD
Site security facilities	Monthly, as needed	GAEPD
Vegetative cover	Semi-annually	GAEPD

**Notes:**

\* - The City of Camilla and Mitchell County have expressed a willingness to assist the Georgia Environmental Protection Division (GAEPD)

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**Table 3-4**  
**Operations and Maintenance Inspection Report**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

INSPECTOR INFORMATION	
Name:	
Organization:	
Department:	
Phone:	

Date: \_\_\_\_\_ Sheet: \_\_\_\_\_ of: \_\_\_\_\_

Weather: \_\_\_\_\_ Report No.: \_\_\_\_\_

ITEMS TO INSPECT	TYPICAL PROBLEMS ENCOUNTERED	CONDITIONS OBSERVED		
		Sat	Unsat	N/A
<b>MONTHLY / AS NEEDED</b>				
Site Security	Trespassing / Vandalism			
Barrier Wall	Monitor Rising Groundwater Levels			
<b>AFTER MAJOR STORM</b>				
Final Cover	Erosion			
	Vegetation stress			
	Settling / Ponding of Water			
	Uplift			
	Washouts			
	Evidence of Leakage Around Penetrations			
	Scouring			
Perimeter Stormwater Ditches	Trash/Vegetative Matter/Sedimentation			
<b>SEMI-ANNUALLY</b>				
Final Cover	Erosion			
	Vegetation stress			
	Settling / Ponding of Water			
	Uplift			
	Washouts			
	Animal Burrows			
	Slope Instability			
	Rock Drainage Ring			
	Rip Rap Drainage Channels			
	Evidence of Leakage Around Penetrations			
	Scouring			
	Mounds			
Barrier Wall	Evidence of Settling			
	Maintenance of Transducer Array			

**Table 3-4**  
**Operations and Maintenance Inspection Report**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

<b>ANNUALLY</b>				
Final Cover	Vegetation Stress			
	Regrading/Backfilling			
Monitoring Wells	High Water Table			
	Missing locks, damaged casing			
	Routine monitoring			
Concrete Foundations	Spalling/Cracking			
	Settlement			
Enforcement of Deed/Construction Restrictions	Unapproved Land Use			

Comments/Recommendations:

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**Table 3-6**  
**Summary of Estimated Operations and Maintenance Costs Years 1 through 30**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

<b>SUMMARY OF O&amp;M COSTS</b>			
Item Description	Total Annual Cost Dollars	Operation Time Years	Present Worth Dollars
Cap Maintenance	\$6,000	30	\$70,862
Groundwater Monitoring (Years 1-5)	\$110,380	5	\$446,585
Groundwater Monitoring (Years 6-30)	\$93,400	25	\$1,041,125
Transducer O&M	\$5,050	30	\$59,642
O&M SUBTOTAL (Years 1-5)	\$121,430		\$577,090
O&M SUBTOTAL (Years 6-30)	\$104,450		\$1,171,630
CONTINGENCY (25% of Subtotal for Years 1-5)	\$30,358		\$144,272
CONTINGENCY (25% of Subtotal for Years 6-30)	\$26,113		\$292,907
SUBTOTAL (Years 1-5)	\$151,788		\$721,360
SUBTOTAL (Years 6-30)	\$130,563		\$1,464,540

<b>CAP MAINTENANCE</b>						
Item Description	Quantity	Units	Unit Price Dollars	Total Annual Cost Dollars	Operation Time, Years	Present Worth
Maintain Vegetation over Capped Area	4	quarterly	\$1,500	\$6,000	30	\$70,862
SUBTOTAL				\$6,000		\$70,862
CONTINGENCY (25% of Subtotal)				\$1,500		\$17,716
TOTAL				\$7,500		\$88,580

**Table 3-6**  
**Summary of Estimated Operations and Maintenance Costs Years 1 through 30**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

<b>GROUNDWATER MONITORING - One ISCO Event (Semi-Annual) and One Comprehensive Event Per Year</b>						
(Assumes that ISCO Performance Monitoring will continue for 5 years and that Comprehensive Monitoring includes ISCO Performance Wells)						
Item Description	Quantity	Units	Unit Price Dollars	Total Annual Cost Dollars	Operation Time, Years	Present Worth
<b>ISCO PERFORMANCE MONITORING (27 SAMPLES)</b>						
Personnel (2-man crew @ 6 12-hour days)	144	hours	\$100	\$2,880	5	\$12,469
Supplies/ Travel	6	days	\$1,000	\$6,000	5	\$25,977
Groundwater Sampling and Lab Testing	27	sample	\$300	\$8,100	5	\$35,069
<b>COMPREHENSIVE ANNUAL MONITORING (69 SAMPLES)</b>						
Personnel (6-man crew @ 6 12-hour days)	432	hours	\$100	\$43,200	30	\$664,090
Supplies/ Travel	6	days	\$3,000	\$18,000	30	\$276,704
Groundwater Sampling and Lab Testing	69	sample	\$300	\$20,700	30	\$318,210
<b>IDW Disposal</b>	1	lump sum	\$3,500	\$3,500	30	\$53,804
<b>Report Preparation (ISCO and Comprehensive Event Results)</b>	80	hours	\$100	\$8,000	30	\$122,980
O&M SUBTOTAL (Years 1-5)				\$110,380		\$1,509,301
O&M SUBTOTAL (Years 6-30)				\$93,400		\$1,435,787
CONTINGENCY (25% of Subtotal for Years 1-5)				\$27,595		\$377,325
CONTINGENCY (25% of Subtotal for Years 6-30)				\$23,350		\$358,947
SUBTOTAL (Years 1-5)				\$137,975		\$1,886,630
SUBTOTAL (Years 6-30)				\$116,750		\$1,794,730

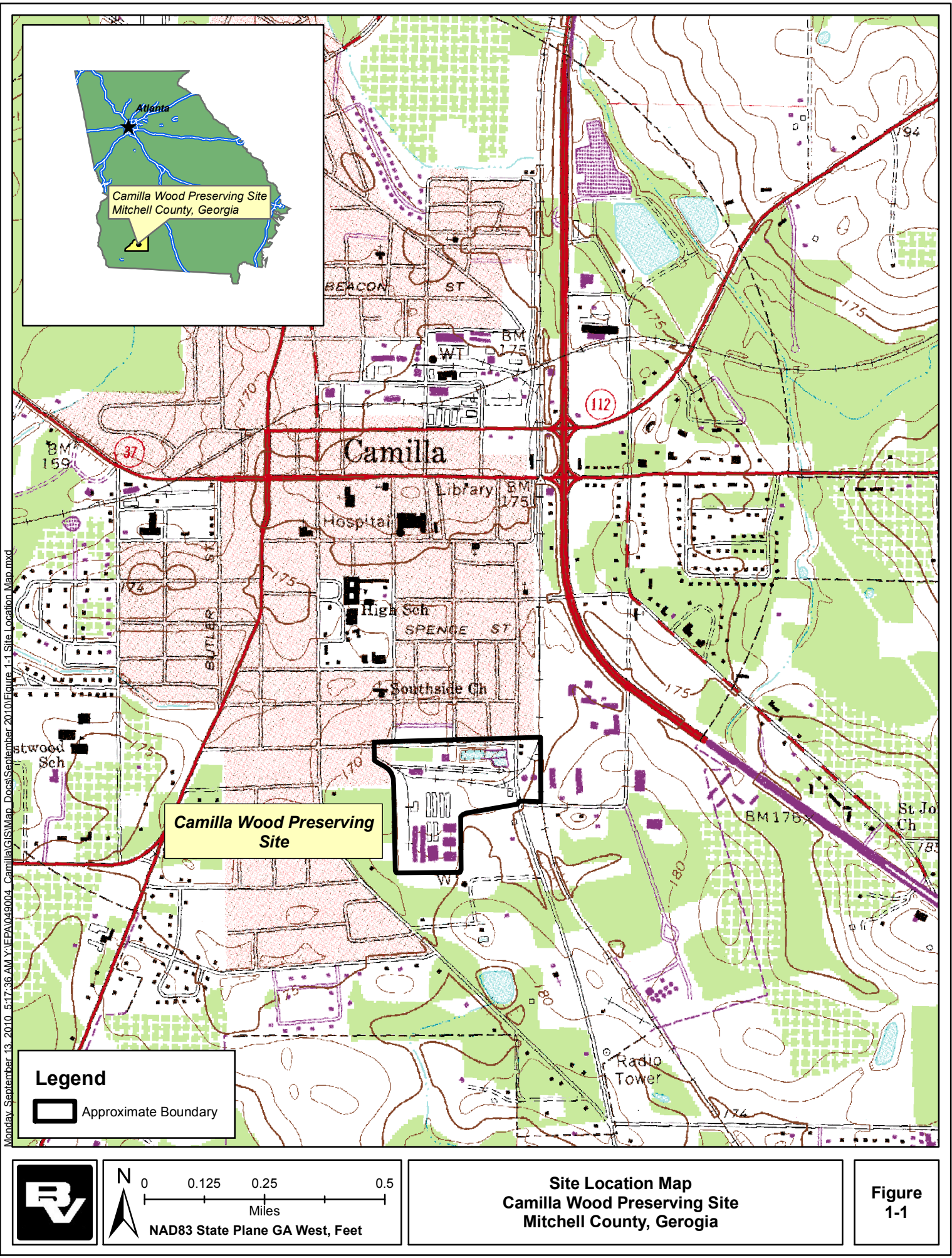
**Table 3-6**  
**Summary of Estimated Operations and Maintenance Costs Years 1 through 30**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

<b>TRANSDUCER O&amp;M</b>						
(Assumes that repairs and equipment checks will be completed during groundwater monitoring activities)						
Item Description	Quantity	Units	Unit Price Dollars	Total Annual Cost Dollars	Operation Time, Years	Present Worth
Equipment Replacement (assumes replacement every 10 years)	1	lump sum	\$17,500	\$1,750	30	\$26,902
Annual Cellular Contract	1	lump sum	\$2,100	\$2,100	30	\$32,282
Monthly Data Analysis (Reporting included with Annual GW Report)	12	hours	\$100	\$1,200	30	\$18,447
O&M SUBTOTAL				\$5,050		\$77,631
CONTINGENCY (25% of Subtotal)				\$1,263		\$19,408
SUBTOTAL				\$6,300		\$97,040

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## Figures

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Stwood Sch

BEACON ST

Camilla

Library

Hospital

High Sch

SPENCE ST

Southside Ch

Camilla Wood Preserving Site

112

37

BM 159

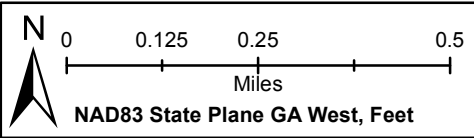
BM 175

BM 175

BM 176

St Jo Ch

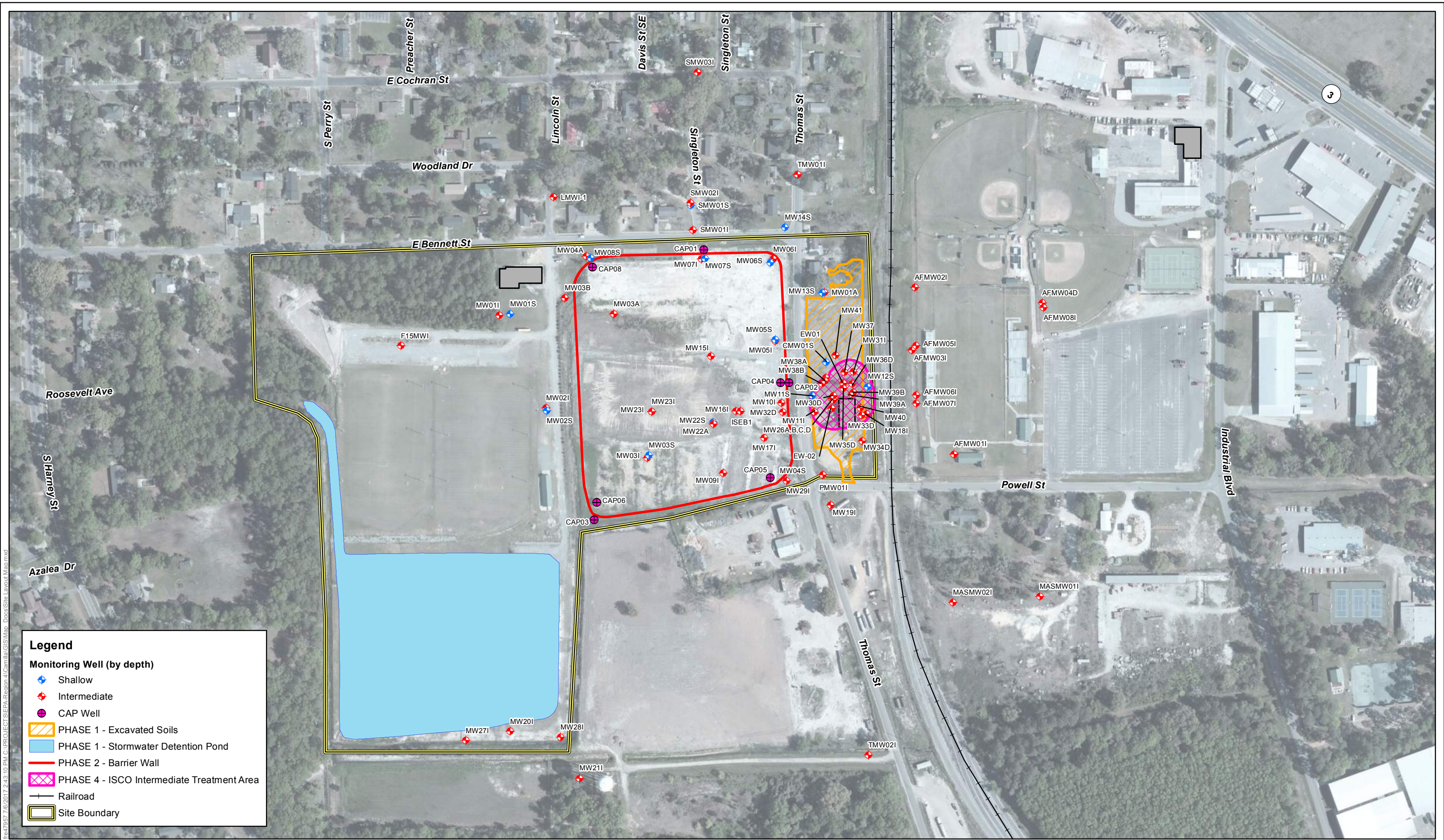
Radio Tower



**Site Location Map  
 Camilla Wood Preserving Site  
 Mitchell County, Georgia**

**Figure 1-1**

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**Legend**

**Monitoring Well (by depth)**

- ◆ Shallow
- ◆ Intermediate
- CAP Well

▨ PHASE 1 - Excavated Soils

■ PHASE 1 - Stormwater Detention Pond

— PHASE 2 - Barrier Wall

▨ PHASE 4 - ISCO Intermediate Treatment Area

— Railroad

▭ Site Boundary

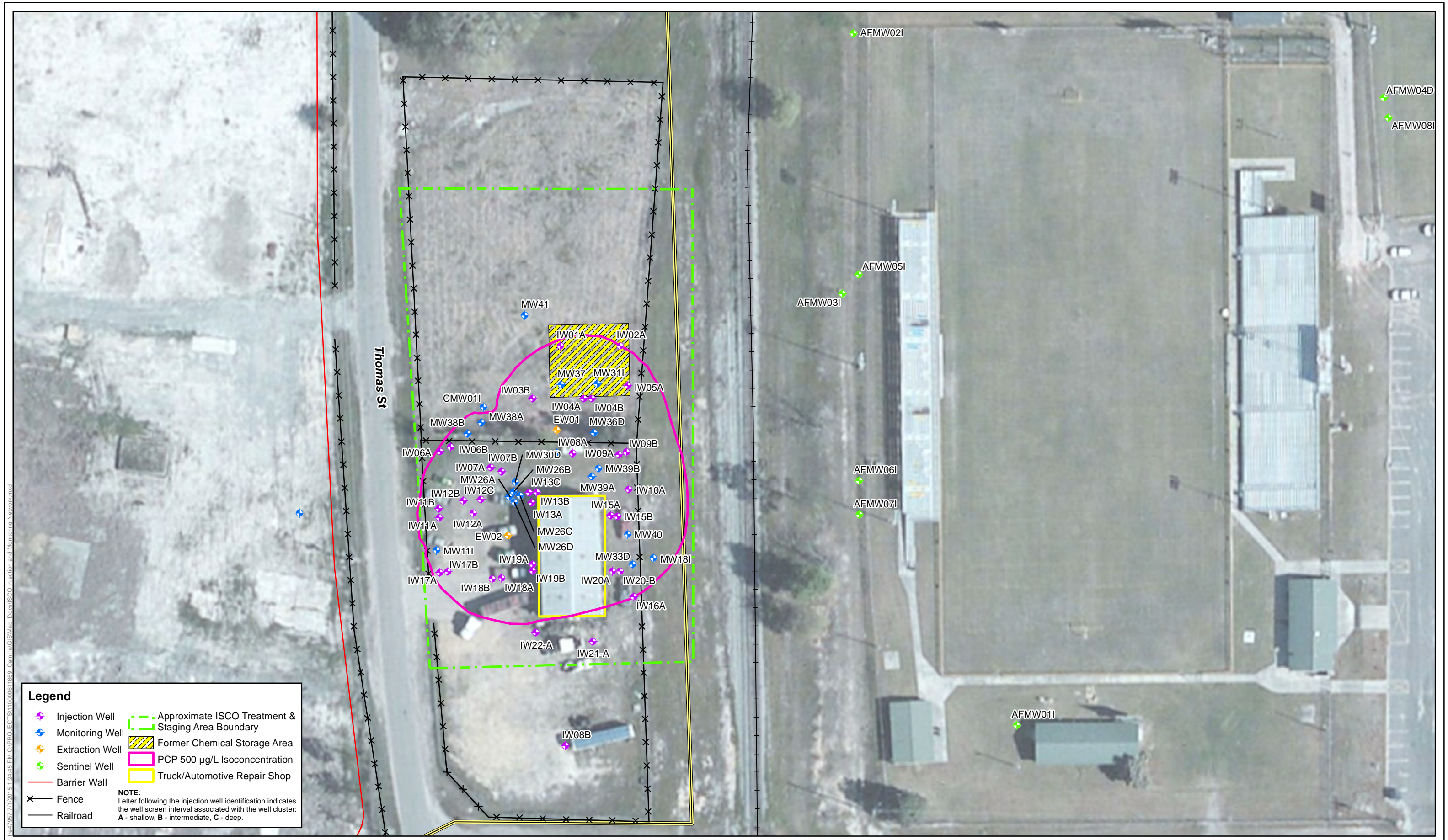
0 250 500  
Feet  
NAD83 State Plane Georgia West, Feet

**Site Layout Map**  
Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia

**Figure**  
1-2

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**Legend**

	Injection Well		Approximate ISCO Treatment & Staging Area Boundary
	Monitoring Well		Former Chemical Storage Area
	Extraction Well		PCP 500 µg/L Isoconcentration
	Sentinel Well		Truck/Automotive Repair Shop
	Barrier Wall		
	Fence		
	Railroad		

**NOTE:**  
 Letter following the injection well identification indicates the well screen interval associated with the well cluster:  
 A - shallow, B - intermediate, C - deep.

0 60 120  
 Feet  
 NAD83 State Plane Georgia West, Feet

**ISCO Injection and Monitoring Network  
 Camilla Wood Preserving Site  
 Camilla, Mitchell County, Georgia**

**Figure  
 2-1**

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MOST RECENT REVISION  
REVISION DATE:  
DRAFTERS INITIALS: JLW

ORIGINAL DWG SIZE  
11 x 17  
LOCATION: R:\49062\0144\03 Eng Support\ACAD\Mon Well Map 8-3-15

CAD DWG NAME: Groundwater Report Maps  
DATE: 8/5/15  
PLOT SCALE: 1:1



### LEGEND

- MW-14S EXISTING MONITORING WELL LOCATION
- CAP-02 CAP WELL LOCATION



CAMILLA WOOD PRESERVING SITE  
CAMILLA, MITCHELL COUNTY, GEORGIA

MONITORING WELL  
LOCATION MAP

FIGURE  
2-2

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## **Appendix A. Figures and As-Built Surveys From RA Report, Rev 1, and Report of Installation of Final Site Finishes, Rev 0**

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MITCHELL COUNTY RECREATION DEPT.

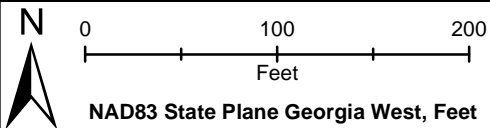
RESIDENTIAL

GEORGIA DOT

VACANT

**Legend**

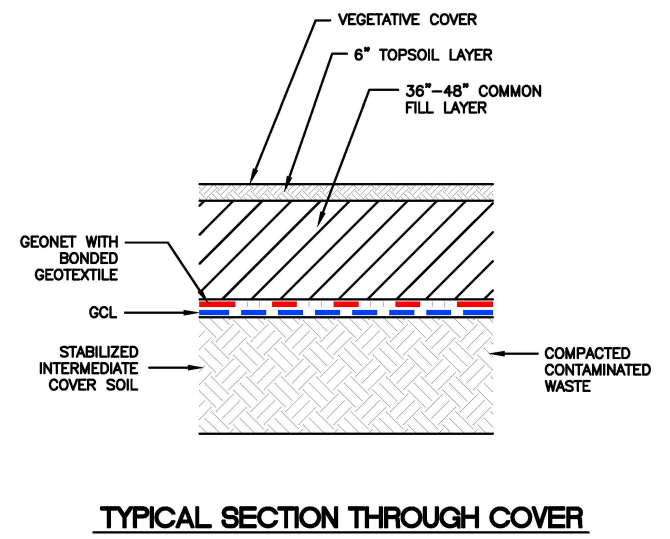
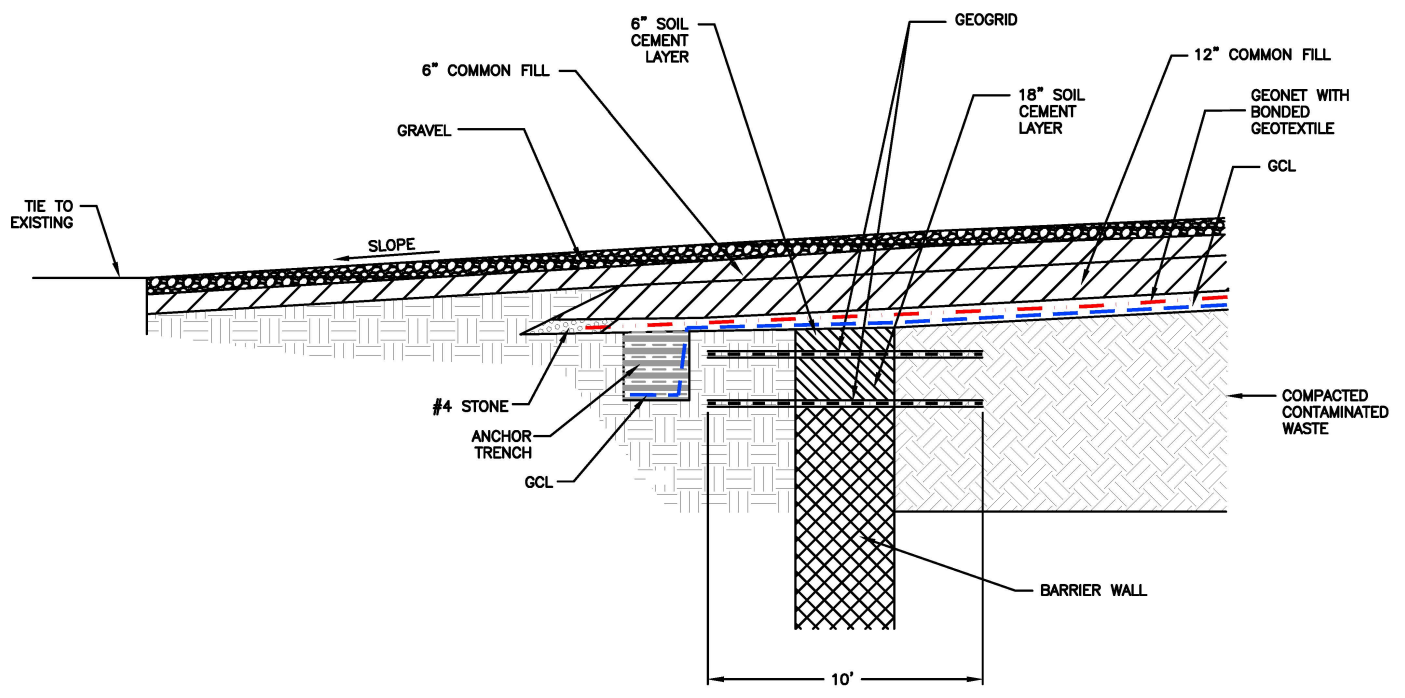
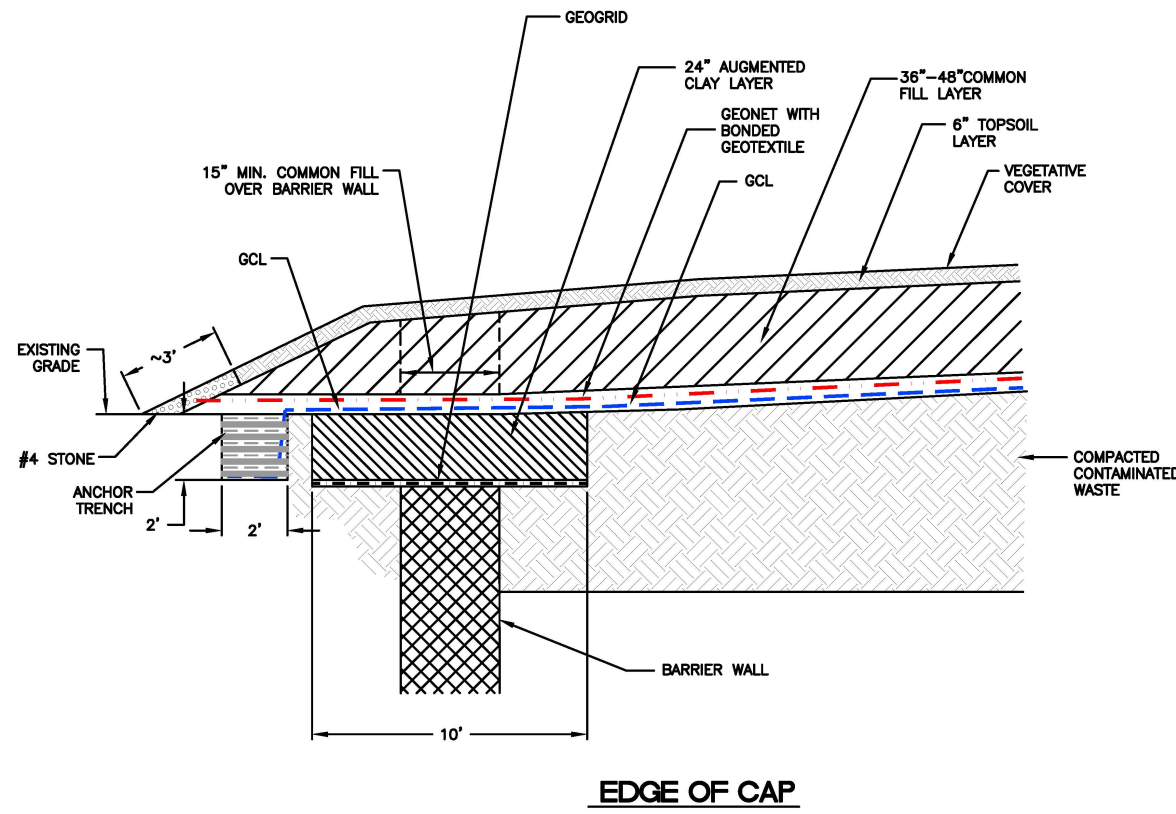
- + Stationing
- BarrierWall
- Railroad
- Site Boundary



**As-Built Barrier Wall Alignment  
Camilla Wood Preserving Site  
Camilla, Mitchell County, Georgia**

**Figure  
4-8**

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Date	By	Check by	Rev.	Description
6/29/15	JLW	CM		
	JLW	ECH		

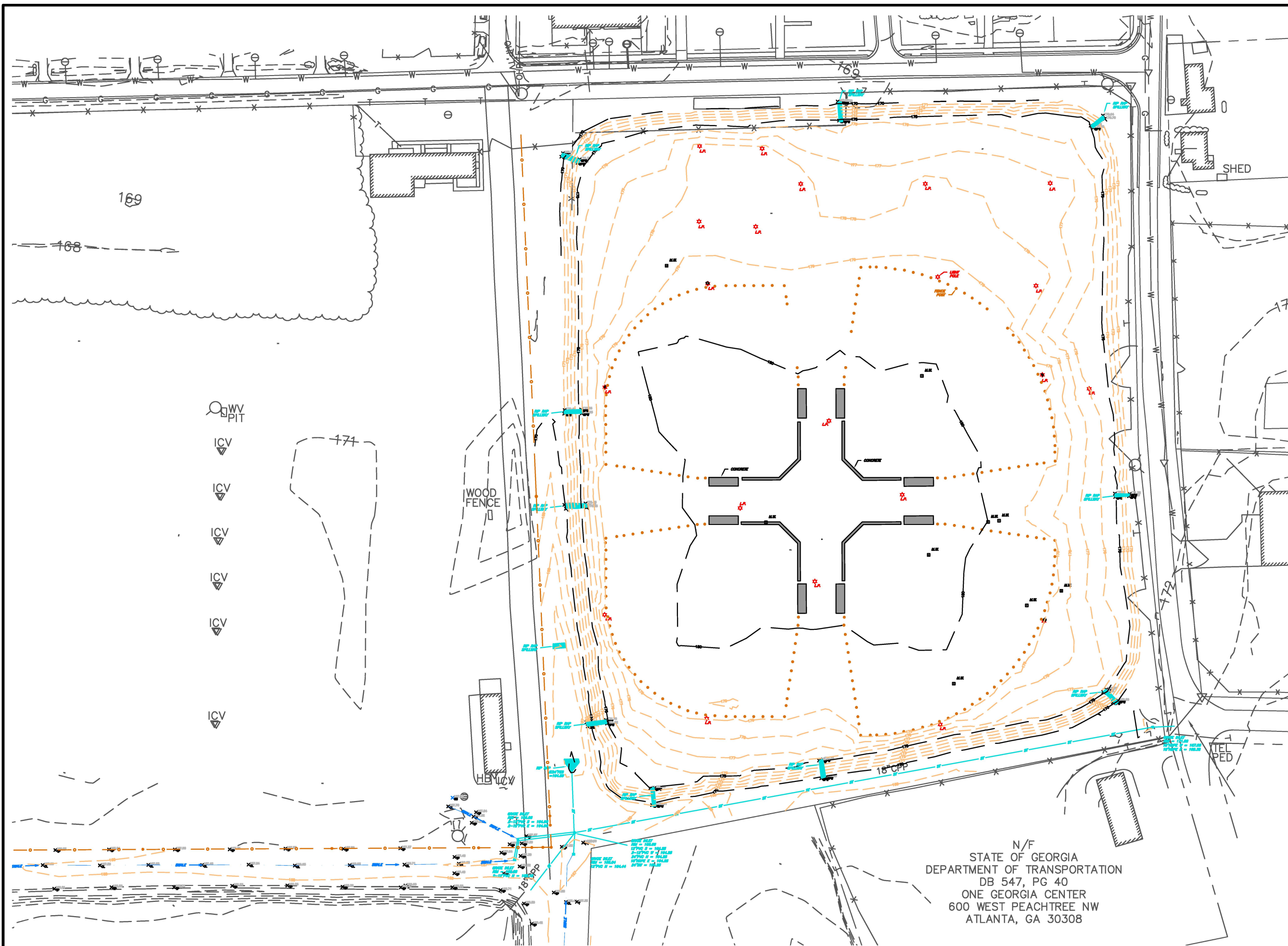
CAMILLA WOOD PRESERVING SITE  
 CAMILLA, MITCHELL COUNTY, GA

AS BUILT CAP  
 AND BARRIER WALL  
 CROSS SECTION DETAILS

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NOTES:

1.



169

168

174

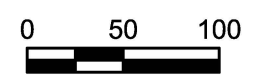
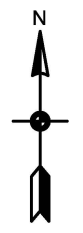
WOOD FENCE

SHED

TEL PED

18\"/>

- WY PIT
- ICV
- ICV
- ICV
- ICV
- ICV
- ICV



N/F  
 STATE OF GEORGIA  
 DEPARTMENT OF TRANSPORTATION  
 DB 547, PG 40  
 ONE GEORGIA CENTER  
 600 WEST PEACHTREE NW  
 ATLANTA, GA 30308

**BLACK & VEATCH**  
 Building a world of difference.

CAMILLA WOOD PROCESSING  
 INSTALLED FOUNDATIONS  
 FIGURE 4-13

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## **Appendix B. Installed Material Cut Sheets**

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## Product Specification - Biaxial Geogrid BX1100

*Tensar International Corporation reserves the right to change its product specifications at any time. It is the responsibility of the specifier and purchaser to ensure that product specifications used for design and procurement purposes are current and consistent with the products used in each instance.*

<b>Product Type:</b>	<b>Integrally Formed Biaxial Geogrid</b>
<b>Polymer:</b>	<b>Polypropylene</b>
<b>Load Transfer Mechanism:</b>	<b>Positive Mechanical Interlock</b>
<b>Primary Applications:</b>	<b>Spectra System (Base Reinforcement, Subgrade Improvement)</b>

### Product Properties

Index Properties	Units	MD Values <sup>1</sup>	XMD Values <sup>1</sup>
▪ Aperture Dimensions <sup>2</sup>	mm (in)	25 (1.0)	33 (1.3)
▪ Minimum Rib Thickness <sup>2</sup>	mm (in)	0.76 (0.03)	0.76 (0.03)
▪ Tensile Strength @ 2% Strain <sup>3</sup>	kN/m (lb/ft)	4.1 (280)	6.6 (450)
▪ Tensile Strength @ 5% Strain <sup>3</sup>	kN/m (lb/ft)	8.5 (580)	13.4 (920)
▪ Ultimate Tensile Strength <sup>3</sup>	kN/m (lb/ft)	12.4 (850)	19.0 (1,300)
<b>Structural Integrity</b>			
▪ Junction Efficiency <sup>4</sup>	%	93	
▪ Flexural Stiffness <sup>5</sup>	mg-cm	250,000	
▪ Aperture Stability <sup>6</sup>	m-N/deg	0.32	
<b>Durability</b>			
▪ Resistance to Installation Damage <sup>7</sup>	%SC / %SW / %GP	95 / 93 / 90	
▪ Resistance to Long Term Degradation <sup>8</sup>	%	100	
▪ Resistance to UV Degradation <sup>9</sup>	%	100	

### Dimensions and Delivery

The biaxial geogrid shall be delivered to the jobsite in roll form with each roll individually identified and nominally measuring 3.0 meters (9.8 feet) or 4.0 meters (13.1 feet) in width and 75.0 meters (246 feet) in length. A typical truckload quantity is 185 to 250 rolls.

### Notes

1. Unless indicated otherwise, values shown are minimum average roll values determined in accordance with ASTM D4759-02. Brief descriptions of test procedures are given in the following notes.
2. Nominal dimensions.
3. Determined in accordance with ASTM D6637-10 Method A.
4. Load transfer capability determined in accordance with ASTM D7737-11.
5. Resistance to bending force determined in accordance with ASTM D7748-12, using specimens of width two ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs, and of length sufficiently long to enable measurement of the overhang dimension.
6. Resistance to in-plane rotational movement measured by applying a 20 kg-cm (2 m-N) moment to the central junction of a 9 inch x 9 inch specimen restrained at its perimeter in accordance with GRI GG9.
7. Resistance to loss of load capacity or structural integrity when subjected to mechanical installation stress in clayey sand (SC), well graded sand (SW), and crushed stone classified as poorly graded gravel (GP). The geogrid shall be sampled in accordance with ASTM D5818 and load capacity shall be determined in accordance with ASTM D6637.
8. Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments in accordance with EPA 9090 immersion testing.
9. Resistance to loss of load capacity or structural integrity when subjected to 500 hours of ultraviolet light and aggressive weathering in accordance with ASTM D4355-05.

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# BENTOMAT® ST

## GEOSYNTHETIC CLAY LINER

BENTOMAT ST CERTIFIED PROPERTIES			
MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY ft <sup>2</sup> (m <sup>2</sup> )	REQUIRED VALUES
Bentonite Swell Index <sup>1</sup>	ASTM D 5890	1 per 50 tonnes	24 ml/2g min.
Bentonite Fluid Loss <sup>1</sup>	ASTM D 5891	1 per 50 tonnes	18 ml max.
Bentonite Mass/Area <sup>2</sup>	ASTM D 5993	40,000 ft <sup>2</sup> (4,000 m <sup>2</sup> )	0.75 lb/ft <sup>2</sup> (3.6 kg/m <sup>2</sup> ) min
GCL Grab Strength <sup>3</sup>	ASTM D 6768	200,000 ft <sup>2</sup> (20,000 m <sup>2</sup> )	30 lbs/in (53 N/cm) MARV
GCL Peel Strength <sup>3</sup>	ASTM D 6496	40,000 ft <sup>2</sup> (4,000 m <sup>2</sup> )	3.5 lbs/in (6.1 N/cm) min
GCL Index Flux <sup>4</sup>	ASTM D 5887	Weekly	1 x 10 <sup>-8</sup> m <sup>3</sup> /m <sup>2</sup> /sec max
GCL Hydraulic Conductivity <sup>4</sup>	ASTM D 5887	Weekly	5 x 10 <sup>-9</sup> cm/sec max
GCL Hydrated Internal Shear Strength <sup>5</sup>	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typ @ 200 psf

***Bentomat ST is a reinforced GCL consisting of a layer of sodium bentonite between a woven and a nonwoven geotextiles, which are needlepunched together.***

**Notes**

<sup>1</sup> Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

<sup>2</sup> Bentonite mass/area reported at 0 percent moisture content.

<sup>3</sup> All tensile strength testing is performed in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496. Upon request, tensile and peel results can be reported per modified ASTM D 4632 using 4 inch grips.

<sup>4</sup> Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 925 gal/acre/day. This flux value is equivalent to a permeability of 5x10<sup>-9</sup> cm/sec for typical GCL thickness. Actual flux values vary with field condition pressures. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided.

<sup>5</sup> Peak values measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

*CETCO has developed an edge enhancement system that eliminates the need to use additional granular sodium bentonite within the overlap area of the seams. We call this edge enhancement, SuperGroove™, and it comes standard on both longitudinal edges of Bentomat® ST. It should be noted that SuperGroove™ does not appear on the end-of-roll overlaps and recommend the continued use of supplemental bentonite for all end-of-roll seams.*

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# GSE FabriNet 200 mil Geocomposite

GSE FabriNet geocomposite consists of a 200 mil thick GSE HyperNet geonet heat-laminated on one or both sides with a GSE nonwoven needle-punched geotextile. The geotextile is available in mass per unit area range of 6 oz/yd<sup>2</sup> to 16 oz/yd<sup>2</sup>. The geocomposite is designed and formulated to perform drainage function under a range of anticipated site loads, gradients and boundary conditions.



**AT THE CORE:**  
A 200 mil thick HyperNet geonet heat-laminated on one or both sides with a nonwoven needlepunched geotextile.

## Product Specifications

Tested Property	Test Method	Frequency	Minimum Average Roll Value <sup>(1)</sup>		
			6 oz/yd <sup>2</sup>	8 oz/yd <sup>2</sup>	10 oz/yd <sup>2</sup>
<b>Geocomposite</b>					
Transmissivity <sup>(2)</sup> , gal/min/ft, (m <sup>2</sup> /sec) Double-Sided Composite Single-Sided Composite	ASTM D 4716	1/540,000 ft <sup>2</sup>	0.5 (1x10 <sup>-4</sup> ) 4.8 (1x10 <sup>-3</sup> )	0.5 (1x10 <sup>-4</sup> ) 4.8 (1x10 <sup>-3</sup> )	0.4 (9x10 <sup>-5</sup> ) 4.3 (9x10 <sup>-4</sup> )
Ply Adhesion, lb/in	ASTM D 7005	1/50,000 ft <sup>2</sup>	1.0	1.0	1.0
<b>Geonet Core<sup>(1,3)</sup> - GSE HyperNet</b>					
Geonet Core Thickness, mil	ASTM D 5199	1/50,000 ft <sup>2</sup>	200	200	200
Transmissivity <sup>(2)</sup> , gal/min/ft (m <sup>2</sup> /sec)	ASTM D 4716		9.6 (2 x 10 <sup>-3</sup> )	9.6 (2 x 10 <sup>-3</sup> )	9.6 (2 x 10 <sup>-3</sup> )
Density, g/cm <sup>3</sup>	ASTM D 1505	1/50,000 ft <sup>2</sup>	0.94	0.94	0.94
Tensile Strength (MD), lb/in	ASTM D 7179	1/50,000 ft <sup>2</sup>	45	45	45
Carbon Black Content, %	ASTM D 4218	1/50,000 ft <sup>2</sup>	2.0	2.0	2.0
<b>Geotextile<sup>(1,3)</sup></b>					
Mass per Unit Area, oz/yd <sup>2</sup>	ASTM D 5261	1/90,000 ft <sup>2</sup>	6	8	10
Grab Tensile Strength, lb	ASTM D 4632	1/90,000 ft <sup>2</sup>	160	220	260
Grab Elongation	ASTM D 4632	1/90,000 ft <sup>2</sup>	50%	50%	50%
CBR Puncture Strength, lb	ASTM D 6241	1/540,000 ft <sup>2</sup>	435	575	725
Trapezoidal Tear Strength, lb	ASTM D 4533	1/90,000 ft <sup>2</sup>	65	90	100
AOS, US sieve <sup>(1)</sup> , (mm)	ASTM D 4751	1/540,000 ft <sup>2</sup>	70 (0.212)	80 (0.180)	100 (0.150)
Permittivity, sec <sup>-1</sup>	ASTM D 4491	1/540,000 ft <sup>2</sup>	1.5	1.3	1.0
Water Flow Rate, gpm/ft <sup>2</sup>	ASTM D 4491	1/540,000 ft <sup>2</sup>	110	95	75
UV Resistance, % retained	ASTM D 4355 (after 500 hours)	per formulation	70	70	70
<b>NOMINAL ROLL DIMENSIONS<sup>(4)</sup></b>					
Roll Width, ft			14.75	14.75	14.75
Roll Length, ft	Double-Sided Composite Single-Sided Composite		270 300	260 300	230 290
Roll Area, ft <sup>2</sup>	Double-Sided Composite Single-Sided Composite		3,982 4,425	3,835 4,425	3,392 4,277

NOTES:

- <sup>(1)</sup> All geotextile properties are minimum average roll values except AOS which is maximum average roll value and UV resistance is typical value. Geonet core thickness is nominal value.
- <sup>(2)</sup> Gradient of 0.1, normal load of 10,000 psf, water at 70°F between steel plates for 15 minutes. Contact GSE for performance transmissivity value for use in design.
- <sup>(3)</sup> Component properties prior to lamination.
- <sup>(4)</sup> Roll widths and lengths have a tolerance of ±1%.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.



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## Rugged **TROLL**® 100 and 200 Data Loggers

Rugged TROLL 100 and 200 Data Loggers are designed for long- and short-term groundwater and surface water monitoring. These non-vented (absolute) water level data loggers measure and record changes in water level, pressure, and temperature. Ensure accurate results by using a Rugged BaroTROLL® Data Logger. All loggers are compatible with user-friendly Win-Situ® Software, which guides you through programming steps, automates level corrections, and accelerates report generation.

### Affordable Titanium Data Loggers

- Get reliable data at a budget-friendly price.
- Use in harsh environments. Solid titanium construction offers chemical- and corrosion-resistance and outlasts specially-coated data loggers.
- Select the appropriate logging mode for your project: Linear, Fast Linear, or Event.

### Flexible Deployment Options

- Deploy zero-maintenance loggers in flood-prone areas, high-humidity environments, and remote locations.
- Choose the cable length and termination type that works best for your project.
- Use suspension wire and backshell hanger for applications requiring minimal instrument access.

### Simplified Setup and Data Retrieval

- Save time and reduce errors with the intuitive Win-Situ 5 and Win-Situ Mobile Software platform. Quickly program loggers, download data, graph results, and more.
- Use a Rugged TROLL Docking Station for programming and downloading data.
- Connect a cabled logger to a telemetry system, radio, controller, or a SCADA/PLC system via Modbus/RS485 or SDI-12 (only Rugged TROLL 200 and Rugged BaroTROLL).

### Outstanding Service

- Receive **free**, 24/7 technical support and online resources.
- Order data loggers and accessories from the In-Situ e-store.
- Get guaranteed 7-day service for maintenance (U.S.A. only).

### Applications

- Coastal wetland and estuary research
- Crest stage gaging and stream gaging
- Drilling and well development
- Flood and storm surge monitoring
- Landfill leachate monitoring

# Rugged TROLL<sup>®</sup> 100 and 200 Data Loggers

General	Rugged TROLL 100 & 200	Rugged BaroTROLL
<b>Temperature ranges<sup>1</sup></b>	Operational: 0-50° C (32-122° F) Storage: -40-80° C (-40-176° F) Calibrated: 0-50° C (32-122° F)	Operational: 0-50° C (32-122° F) Storage: -40-80° C (-40-176° F) Calibrated: 0-50° C (32-122° F)
<b>Diameter</b>	2.62 cm (1.03 in.)	2.62 cm (1.03 in.)
<b>Length</b>	14.43 cm (5.68 in.)	14.43 cm (5.68 in.)
<b>Weight</b>	170 g (0.37 lb)	170 g (0.37 lb)
<b>Materials</b>	Titanium body; Delrin <sup>™</sup> nose cone, hanger, backend	Titanium body; Delrin nose cone, hanger, backend
<b>Output options</b>	Rugged TROLL 100: USB or RS232 via docking station Rugged TROLL 200: USB or RS232 via docking station; Modbus/RS485 or SDI-12 via Rugged TROLL 200 Cable	USB or RS232 via docking station; Modbus/RS485 or SDI-12 via Rugged TROLL 200 Cable
<b>Battery type &amp; life<sup>2</sup></b>	3.6V lithium; 10 years or 2M readings	3.6V lithium; 10 years or 2M readings
<b>External power</b>	Rugged TROLL 100: NA Rugged TROLL 200: 8-36 VDC	8-36 VDC
<b>Memory</b>	1.0 MB	1.0 MB
<b>Data records<sup>3</sup></b>	65,000	65,000
<b>Data logs</b>	Rugged TROLL 100: 1 log Rugged TROLL 200: 2 logs	2 logs
<b>Fastest logging rate</b>	1 per second	1 per minute
<b>Fastest output rate</b>	Rugged TROLL 200 only Modbus & SDI-12: 1 per second	Modbus & SDI-12: 1 per second
<b>Log types</b>	Linear, Fast Linear, and Event	Linear
<b>Sensor Type/ Material</b>	Piezoresistive; Ceramic	Piezoresistive; Ceramic
<b>Range</b>	9.0 m (30 ft) (Burst: 18 m; 60 ft) 30 m (100 ft) (Burst: 40 m; 134 ft) 76 m (250 ft) (Burst: 112 m; 368 ft)	7 to 30 psi; 0.5 to 2 bar
<b>Accuracy<sup>4</sup></b>	±0.1% full scale (FS) typical ±0.3% FS max.	±0.1% FS typical ±0.3% FS max.
<b>Resolution</b>	±0.01% FS or better	±0.01% FS or better
<b>Units of measure</b>	Pressure: psi, kPa, bar, mbar, mmHg Level: in., ft, mm, cm, m	Pressure: psi, kPa, bar, mbar, mmHg, inHg
<b>Temperature Sensor</b>	Silicon	Silicon
<b>Accuracy</b>	±0.3° C	±0.3° C
<b>Resolution</b>	0.01° C or better	0.01° C or better
<b>Units of measure</b>	Celsius or Fahrenheit	Celsius or Fahrenheit
<b>Warranty</b>	2 years	2 years
<b>Notes</b>	<sup>1</sup> Temperature range for non-freezing liquids. <sup>2</sup> Typical battery life when used within the factory-calibrated temperature range. <sup>3</sup> 1 data record = date/time plus 2 parameters logged (no wrapping) from device within the factory-calibrated temperature range. <sup>4</sup> Across factory-calibrated pressure and temperature ranges. Delrin is a registered trademark of E.I. du Pont de Nemours & Co. Specifications are subject to change without notice.	



## Rugged BaroTROLL<sup>®</sup> Data Logger

Use the titanium Rugged BaroTROLL with either a Rugged TROLL 100 or 200 Data Logger. Win-Situ<sup>®</sup> Baro Merge<sup>®</sup> Software simplifies post-correction of water level data for barometric pressure changes.

## Rugged TROLL<sup>®</sup> 200 Cable

Access real-time data by using Rugged TROLL 200 Cable with a Rugged TROLL 200 or a Rugged BaroTROLL. Use a Cable Suspension Kit to anchor the cable in place. Available configurations:

- Modbus/RS485 stripped-and-tinned cable or SDI-12 stripped-and-tinned cable—Use with PLC, telemetry system, or logger.
- Modbus/RS485 top-of-well cable—Use with Rugged TROLL Com Device and a RuggedReader<sup>®</sup> Handheld PC or a PC.

<b>Jacket options</b>	TPU (thermoplastic polyurethane)
<b>Conductors</b>	4 conductors, 24 AWG, polypropylene insulation
<b>Diameter</b>	Cable: 5.1 mm (0.200 in.) Connector: 26.1 mm (1.03 in.)
<b>Cable lengths</b>	Modbus/RS485: Customizable up to 300 m (1,000 ft) SDI-12: Standard lengths up to 60 m (200 ft)
<b>Minimum bend radius</b>	5X cable diameter
<b>Break strength</b>	68 kg (150 lbs)

## Rugged TROLL<sup>®</sup> Com Communication Device

Use the Rugged TROLL Com Device for communication between a cabled Rugged TROLL 200 or a cabled Rugged BaroTROLL and a RuggedReader Handheld PC or a laptop/PC.

<b>Operating temp. range</b>	0-50° C (32-122° F)
<b>Storage temp. range</b>	-40-80° C (-40-176° F)
<b>Materials</b>	Delrin, rubber, copper pins
<b>Environmental rating</b>	IP67 with battery cover closed
<b>Dimensions (LxWxH)</b>	8.9 x 2.9 x 4.8 cm (3.5 x 1.14 x 1.88 in.)
<b>Input connection</b>	Modbus/RS485
<b>Output connection</b>	Available with either USB or RS232
<b>Power source</b>	9V alkaline battery, user-replaceable
<b>Cable</b>	Black polyurethane, 91 cm (3 ft) long

## Rugged TROLL<sup>®</sup> Docking Station

Use the docking station to program and download data from a Rugged TROLL 100 or 200 or from a Rugged BaroTROLL. The docking station is available with either a USB or RS232 communication interface. USB allows fast data transfer to a PC. Use the RS232 version with a laptop/PC or a RuggedReader Handheld PC.



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## Cellular Network Telemetry Systems

Quickly connect to remote monitoring stations by using cellular network technology. Economical, secure telemetry systems reduce data collection costs by providing real-time access to data, event notifications, and system status updates. Superior power supply management ensures long-lasting, independent operation at remote sites.

### Real-Time Data

- Easily integrate systems into HydroVu data services for real-time evaluation of site data and conditions.
- Receive automatic data log uploads to your email, FTP site, or other current data management platform at customized intervals.
- Never miss a data point. The system recognizes missed data and sends that data on the next transmission.

### Real-Time Decisions

- Integrate with HydroVu for up-to-date access to your data in the format you want, whenever and wherever you are, while simplifying the task of filtering the data for important results.
- Quickly respond to user-defined field events or to tampering. Automatic alarm notifications are sent to your email or phone via text message.
- Significantly reduce site visits. Receive system status updates, diagnose problems, and perform preventative and corrective maintenance from your office.

**Tube Systems:** For in-well deployments and low-profile installations, choose the battery-powered Tube 300R. For high-frequency sampling, choose the solar-powered Tube 300S.

**Cube Systems:** For sites that require multiple sensors, choose the battery-powered Cube 300R or the solar-powered Cube 300S. Connect up to five instruments to one Cube.

Both the Tube and Cube Systems offer data logging and transmission, and alarm notifications for parameter thresholds, instrument malfunction, and tampering detection.

### Real-Time Support

- Receive free, 24/7 technical support and online resources.
- Order instruments and accessories from the In-Situ website.
- Troubleshoot deployment issues by using an external mode.
- Duplicate logs on the data logger and the telemetry system for confidence in the most remote locations.

### Applications

- Long-term groundwater and surface-water monitoring
- Event notification-crest stage gages, flood warning system, storm surge, slope stability
- Mine dewatering and acid mine drainage
- Stormwater management
- Tide gaging

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General	Tube 300R	Tube 300S	Cube 300R	Cube 300S
<b>Operating ranges<sup>1</sup></b>	Temp: -20-70° C (-4-158° F) Humidity: 95% max. n.c.	Temp: -20-70° C (-4-158° F) Humidity: 95% max. n.c.	Temp: -20-70° C (-4-158° F) Humidity: 95% max. n.c.	Temp: -20-70° C (-4-158° F) Humidity: 95% max. n.c.
<b>Diameter, maximum</b>	Tube: 5 cm (1.97 in.) Top cap: 5.2 cm (2.05 in.)	Tube: 7 cm (2.75 in.) Top cap: 7.5 cm (2.95 in.) (with solar panel)	NA	NA
<b>Dimensions</b>	Length: 48 cm (18.9 in.)	Length: 48 cm (18.9 in.)	20 x 18 x 8.5 cm (7.87 x 7.1 x 3.35 in.)	36 x 24 x 13 cm (14.2 x 9.4 x 5.1 in.)
<b>Weight with battery</b>	1730 g (3.81 lbs)	1670 g (3.68 lbs)	1345 g (2.965 lbs)	3100 g (6.83 lbs)
<b>Materials</b>	Stainless steel	Methacrylate, 5 mm thick	GW PLAST 75	GW PLAST 75
<b>Ratings</b>	IP68 (cannot operate submerged)	IP65	IP65	IP65
<b>Power</b> Internal Battery	Battery Lithium 10.8V / 19000 mAh	Solar panels integrated NiCd 7.2V / 1400 mAh	Battery Lithium 10.8V / 19000 mAh	Solar panels integrated NiCd 7.2V / 1400 mAh
<b>Connectors</b>	1 twist-lock connector	1 twist-lock connector	5 twist-lock connectors	5 twist-lock connectors
<b>Operation Time</b>	Up to 5 years when logging every 10 min. and uploading data 1/day	Solar panel power: Unlimited, depending on sunlight exposure and programmed activities	Up to 5 years when logging every 10 min. and uploading data 1/day	Solar panel power: Unlimited, depending on sunlight exposure and programmed activities
<b>Common Specs</b>				
<b>Sensor compatibility</b>	Aqua TROLL® 100/200 Data Loggers; Aqua TROLL 400 Multiparameter Instrument; BaroTROLL® Data Logger; Level TROLL 400/500/700/700H Data Loggers; TROLL 9500 Multiparameter Instrument; Rugged Troll 200; RDO Pro-X			
<b>Communication</b> Antenna	GSM quad band—850, 900, 1800, 1900 MHz (capable of GPRS, SMS, email, and FTP); 2G available SMA connector with stud antenna or optional external antenna for Tube 300R			
<b>Data access/storage</b> Data access Data storage Data format	Via email or FTP; via cable; and real-time via GSM/GPRS direct call or HydroVu data services SD Flash memory, 512 MB (not replaceable) CSV file			
<b>Programming</b> Programming mode Operation mode	Through ANT tool communication software, via cable, or remotely via landline or GSM modem Through communication software tool via direct connection to a PC or remotely through GSM modem or landline modem. 1. Up to 8 programmable events/day; data transmission; or SMS transmission 2. Automatic data logging (reading interval: 1 minute to 24 hours) 3. Alarm transmission (SMS) 4. Data logging and batch transmission of stored data. Connect up to 5 probes and log all available (includes data from internal barometric pressure sensor).			
<b>Interfaces</b> Serial Interfaces	RS232 or RS485 software selectable (with automatic RS232 switching when a PC connection is detected)			
<b>Alarm capability</b> Capacity Sources SMS limits	The unit can generate an alarm if tilted or disconnected; if exceeds critical temperature values or parameters threshold values; or if battery levels reach critical. Via SMS. 2 recipients Up to 8 alarm sources Can be programmed			
<b>Real-time clock/calendar</b>	Built-in			
<b>Sensors</b>	Built-in barometric pressure sensor included with non-vented systems, which automates barometric pressure compensation for non-vented water level sensors. Built-in temperature sensor			
<b>Warranty</b>	<b>1 year</b>			
<b>Notes</b>	* Refer to Alarms section in manual. Alarm sources: reset, temperature, tilt sensor, data send failure, low battery, probe reading out of range, tamper, log memory full or error, and probe reading error Specifications subject to change without notice			



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## ATTACHMENT 1 TRANSDUCER INSTALLATION INFORMATION

### **Transducer Station Locations and Rationale**

A network of ten (10) existing monitoring wells was selected for transducer deployment, and transducers were installed into each monitoring well on November 20, 2015. Tables 1 through 3 were included in *Pressure Transducer Technical Memo #1* and *Pressure Transducer Technical Memo #2*, but have been included in this Attachment 1 for ease of reference. Table 1 describes the rationale for the deployment of each transducer into each selected well. Monitoring of groundwater elevations in eight of the wells is associated with the existing barrier wall and capping containment system. These eight wells are represented by Transducer Stations #1 through #4, with each station consisting of two wells. Transducer Station #5 consists of the two remaining monitoring wells (MW01I and MW01S), where the transducers were installed to monitor background groundwater elevations in the intermediate and shallow groundwater aquifers. The transducer stations have cellular capabilities for remote data download, with one cellular unit at each transducer station. Monitoring well details for wells associated with Transducer Stations are presented in Table 2. Transducer deployment is summarized on Table 3. Field records associated with the transducer installations on November 20, 2015 are included as Attachment 1 in *Pressure Transducer Technical Memo #1*.

**Table A1:  
Transducer Station Location Summary**

Transducer Station Location	Monitoring Wells Involved	Location Rationale
Transducer Station #1	Tandem of MW08S (outside barrier wall) and CAP08 (inside barrier wall)	Monitoring groundwater levels inside/outside barrier wall along northwestern boundary.
Transducer Station #2	Tandem of CAP02 (outside barrier wall) and CAP04 (inside barrier wall)	Monitoring of groundwater levels inside/outside barrier wall along eastern boundary.
Transducer Station #3	Tandem of MW04S (outside barrier wall) and CAP05 (inside barrier wall)	Monitoring groundwater levels inside/outside barrier wall along southeastern boundary.
Transducer Station #4	Tandem of CAP03 (outside barrier wall) and CAP06 (inside barrier wall)	Monitoring groundwater levels inside/outside barrier wall along southwestern boundary.
Transducer Station #5	Tandem of MW01I (intermediate) and MW01S (shallow).	Background monitoring of intermediate and shallow aquifer groundwater levels.

**Table A2:  
Monitoring Well Details**

Well ID	Total Depth (ft BTOC)	Approximate Screen Length (ft)	Aquifer	Northing	Easting	Notes
CAP02	19.40	10	Shallow	444439.610	2285610.200	Flush mount outside eastern barrier wall.
CAP03	18.93	10	Shallow	444050.190	2285057.280	Flush mount outside southwestern barrier wall.
CAP04	25.80	10	Shallow	444440.200	2285585.950	Flush mount inside eastern barrier wall.
CAP05	25.38	10	Shallow	444169.900	2285557.320	Flush mount inside southeastern barrier wall.
CAP06	24.34	10	Shallow	444100.130	2285064.410	Flush mount inside southwestern barrier wall.
CAP08	25.53	10	Shallow	444768.340	2285052.420	Flush mount inside northwestern barrier wall.
MW04S	14.75	10	Shallow	444160.997	2285602.486	Flush mount outside southeastern barrier wall.
MW08S	14.48	10	Shallow	444794.061	2285047.342	Flush mount outside northwestern barrier wall.
MW-01I	67	12	Intermediate	444631.566	444631.566	Monument (stickup) west of containment cell; south of recreation center.
MW-01S	20	11	Shallow	444636.045	444636.045	Monument (stickup) west of containment cell; south of recreation center.

**Notes:**

BTOC = below top of casing  
ft. = feet

**Table A3:  
Transducer Deployment Summary (November 20, 2015)**

Monitoring Well	Serial Number of Transducer	Transducer Station Location	Water Level at time of transducer installation (feet BTOC)	Depth of Transducer Sensor (feet BTOC)	Sensor Elevation (NAVD88)	Cube Transmitter Assigned
CAP08	424025	1	16.25	18.83	156.57	15112138
MW08S	431040		0.23	6.67	163.35	
CAP04	428512	2	15.85	19.67	156.48	15081907
CAP02	431207		4.61	13.81	157.88	
MW04S	430855	3	2.21	8.81	161.32	15112140
CAP05	427063		18.82	19.71	157.11	
CAP06	427177	4	18.69	19.77	155.63	15112139
CAP03	431168		2.72	12.71	155.94	
MW01I	423854	5	49.87	60.00	108.90	15081906
MW01S	431265		2.72	15.00	153.82	

**Notes:**

BTOC = below top of casing  
ft. = feet

### **Transducer Equipment, Installation, and Programming**

A summary of the transducer equipment, installation of transducers, and programming are described in detail in the *Pressure Transducer Technical Memo #1*. Each pressure transducer consists of an In Situ® Rugged TROLL 200 in each of the ten monitoring wells, along with a Cube 300R Telemetry Transmitter at each station. Manufacturer's information sheets for the transducers and telemetry units are included in Attachment 2 of *Pressure Transducer Technical Memo #1*. The Cube 300R Telemetry Transmitters also contain barometers and correct all transducer data for barometric pressure prior to transmittal (via cellular).

The pressure transducers are programmed to collect water pressure readings every 30 minutes, which has remained the same since installation of the pressure transducers in November 2015. The transducer data is transmitted (via cellular) every 72 hours, and is subsequently downloaded by Black & Veatch.

The weather station at C.M. Stripling Irrigation Research Park in Camilla has been utilized to track precipitation in the region, and to compare to the transducer data. The precipitation data from the weather station can be found at: <http://weather.uga.edu/index.php?variable=HI&site=CAMILLA>. The weather station is located approximately 6.5-miles northwest of the Site. Rainfall data has been provided on Figures 2, 3, and 4. In previous Pressure Transducer Memos, the rainfall data for December 31, 2015 was not available. The rainfall data (0.83 inches of rainfall) for December 31, 2015 is now available, and this data is included in this Pressure Transducer Technical Memo.

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**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: CAPO8

Date of Transducer Installation: 11/20/15

Installer: P. Cole

Water Level Data (BTOC): 16.25'

Total Well Depth (BTOC): 25.53'

Depth of Transducer Sensor (BTOC): 18.83'

Feet of Water above Transducer Sensor: 2.58'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 424025

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15112138

Is Telemetry Transmitter shared with another well? If so, identify well number: Yes - MW085

Is the well flushmount or stickup?: Flushmount

Notes: Temporary PVC stickup of 1.17' added to top of casing of CAPO8 to prevent surface water from going down flushmount well. All measurements above are corrected to the true top of casing of CAPO8. CUBE300R is setup to transmit data (via cellular) every 72 hours

**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: MW085

Date of Transducer Installation: 11/20/15

Installer: P. Cole

Water Level Data (BTOC): 0.23'

Total Well Depth (BTOC): 14.48'

Depth of Transducer Sensor (BTOC): 6.67'

Feet of Water above Transducer Sensor: 6.64'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 431040

Type of Telemetry Transmitter: COBE 300R

Telemetry Transmitter Serial Number: 15112138

Is Telemetry Transmitter shared with another well? If so, identify well number: Yes - CAP08

Is the well flushmount or stickup?: Flushmount

Notes: Temporary PVC stickup of 1.25' added to top of casing of MW085 to prevent surface water from going down flushmount well. All measurements above are corrected to true top of casing of MW085. COBE 300R is setup to transmit (via cellular) every 72 hours.

**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: CAPO4

Date of Transducer Installation: 11/20/15

Installer: P. Cole

Water Level Data (BTOC): 15.85'

Total Well Depth (BTOC): 25.80'

Depth of Transducer Sensor (BTOC): 19.67'

Feet of Water above Transducer Sensor: 3.82'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 428512

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15081907

Is Telemetry Transmitter shared with another well? If so, identify well number: Yes - CAPO2

Is the well flushmount or stickup?: Flushmount

Notes: Temporary PVC stickup of 1.25' added to top of casing of CAPO4 to prevent surface water from going down flushmount well. All measurements above are corrected to the true top of casing of CAPO4. CUBE 300R is setup to transmit every 72 hours.

**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: CAPO2

Date of Transducer Installation: 11/20/15

Installer: P. Cole

Water Level Data (BTOC): 4.61'

Total Well Depth (BTOC): 19.40'

Depth of Transducer Sensor (BTOC): 13.81'

Feet of Water above Transducer Sensor: 9.20'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 431207

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15081907

Is Telemetry Transmitter shared with another well? If so, identify well number: Yes - CAPO4

Is the well flushmount or stickup?: Flushmount

Notes: Temporary PVC stickup of 1.19' added to top of casing of CAPO2 to prevent surface water from going down flushmount well. All measurements above are corrected to the true top of casing of CAPO2. CUBE 300R setup to transmit every 72 hours.

**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: MW04S

Date of Transducer Installation: 11/20/15

Installer: P. Colb

Water Level Data (BTOC): 2.21'

Total Well Depth (BTOC): 14.75'

Depth of Transducer Sensor (BTOC): 8.81'

Feet of Water above Transducer Sensor: 6.60'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 430855

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15112140

Is Telemetry Transmitter shared with another well? If so, identify well number: YES - CAPO5

Is the well flushmount or stickup?: Flushmount

Notes: Temporary PVC stickup of 1.19' added to top of casing of MW04S to prevent surface water from going down flushmount well. All measurements above are corrected to true top of casing of MW04S. CUBE 300R is setup to transmit every 72 hours.

**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: CAPOS

Date of Transducer Installation: 11/20/15

Installer: P. Cole

Water Level Data (BTOC): 18.82'

Total Well Depth (BTOC): 25.38'

Depth of Transducer Sensor (BTOC): 19.71'

Feet of Water above Transducer Sensor: 0.89'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 427063

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15112140

Is Telemetry Transmitter shared with another well? If so, identify well number: YES - MW04S

Is the well flushmount or stickup?: Flushmount

Notes: Temporary PVC stickup of 1.29' added to the top of casing of CAPOS to prevent surface water from going down the flushmount well. All measurements above are corrected to true top of casing for CAPOS. CUBE 300R is setup to transmit every 72 hours.

**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: CAPO6

Date of Transducer Installation: 11/20/15

Installer: P. Colb

Water Level Data (BTOC): 18.69'

Total Well Depth (BTOC): 24.34'

Depth of Transducer Sensor (BTOC): 19.77'

Feet of Water above Transducer Sensor: 1.08'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 427177

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15112139

Is Telemetry Transmitter shared with another well? If so, identify well number: YES - CAPO3

Is the well flushmount or stickup?: Flushmount

Notes: Temporary PVC stickup of 1.40' added to the top of casing of CAPO6. to prevent surface water from going down flushmount well. All measurements above are corrected to the true top of casing of CAPO6. CUBE 300R is setup to transmit every 72 hours.

**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: CAPO3

Date of Transducer Installation: 11/20/15

Installer: P. Cole

Water Level Data (BTOC): 2.72'

Total Well Depth (BTOC): 18.93'

Depth of Transducer Sensor (BTOC): 12.71'

Feet of Water above Transducer Sensor: 9.99'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 431168

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15112139

Is Telemetry Transmitter shared with another well? If so, identify well number: YES - CAPO6

Is the well flushmount or stickup?: Flushmount

Notes: Temporary PVC stickup of 1.29' added to the top of casing of CAPO3 to prevent surface water from going down flushmount well. All measurements above are corrected to the true top of casing of CAPO3. CUBE 300R is setup to transmit every 72 hours.

**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: MW01I

Date of Transducer Installation: 11/20/15

Installer: P. Cole

Water Level Data (BTOC): 49.87'

Total Well Depth (BTOC): 67'

Depth of Transducer Sensor (BTOC): 60.00'

Feet of Water above Transducer Sensor: 10.13'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 423854

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15081906

Is Telemetry Transmitter shared with another well? If so, identify well number: YES - MW01S

Is the well flushmount or stickup?: Stickup

Notes: CUBE 300R setup to transmit every 72 hours

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**Transducer Deployment Form**  
**Camilla Wood Preserving Site**  
**Camilla, Mitchell County, Georgia**

Well ID: MW015

Date of Transducer Installation: 11/20/15

Installer: P. Cole

Water Level Data (BTOC): 2.72'

Total Well Depth (BTOC): 20'

Depth of Transducer Sensor (BTOC): 15.00'

Feet of Water above Transducer Sensor: 12.28'

Transducer Type: Rugged Troll 200

Transducer Serial Number: 431265

Type of Telemetry Transmitter: CUBE 300R

Telemetry Transmitter Serial Number: 15081906

Is Telemetry Transmitter shared with another well? If so, identify well number: YES - MW01 I

Is the well flushmount or stickup?: Stickup

Notes: CUBE 300R setup to transmit every 72 hours.

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## **Appendix C. Monitoring Well and Extraction Well Details**

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# EXTRACTION WELL (EW-01) CONSTRUCTION DETAIL

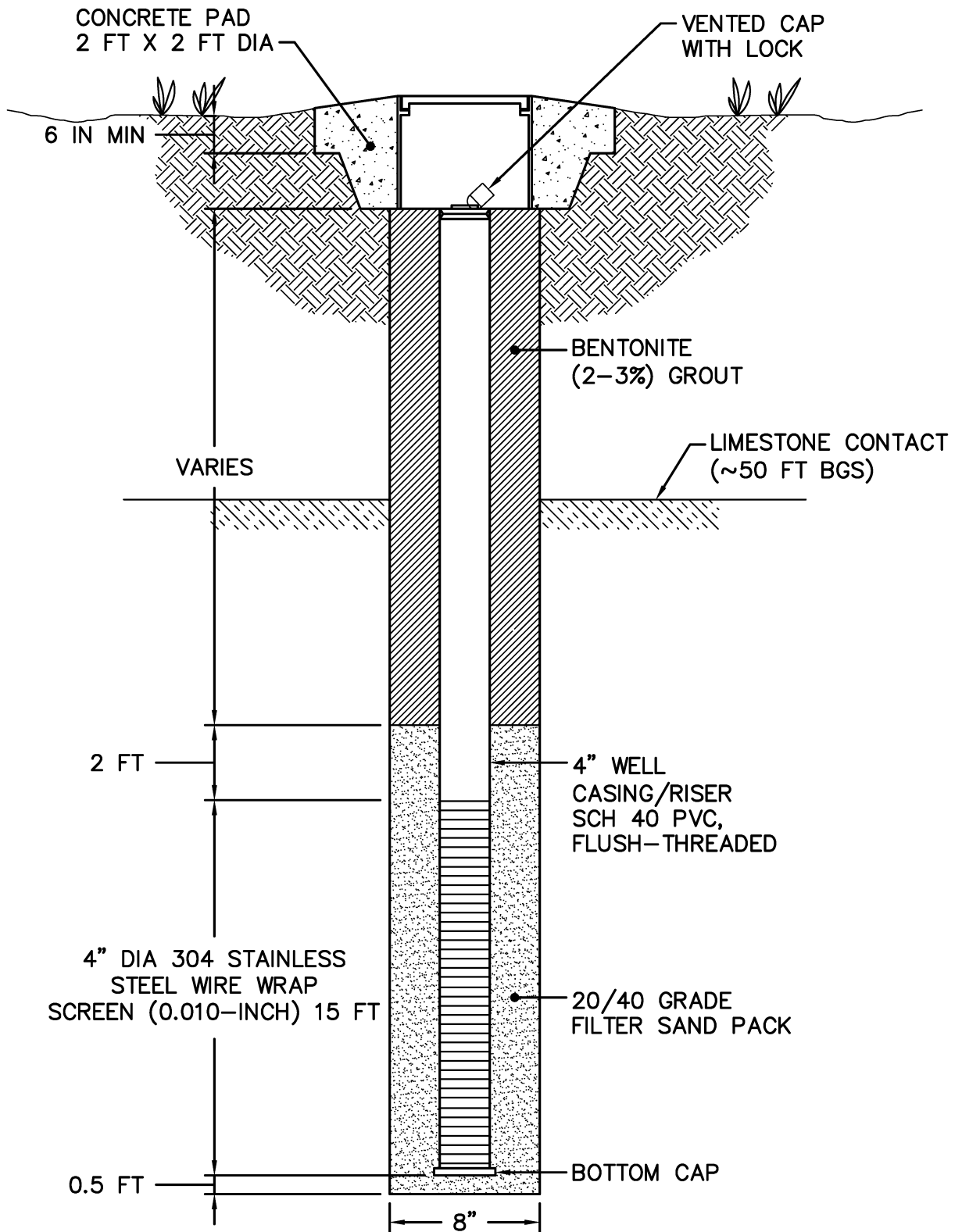


FIGURE 3

CAMILLA WOOD PRESERVING SITE  
CAMILLA, MITCHEL COUNTY, GEORGIA

**Geosyntec**  
consultants

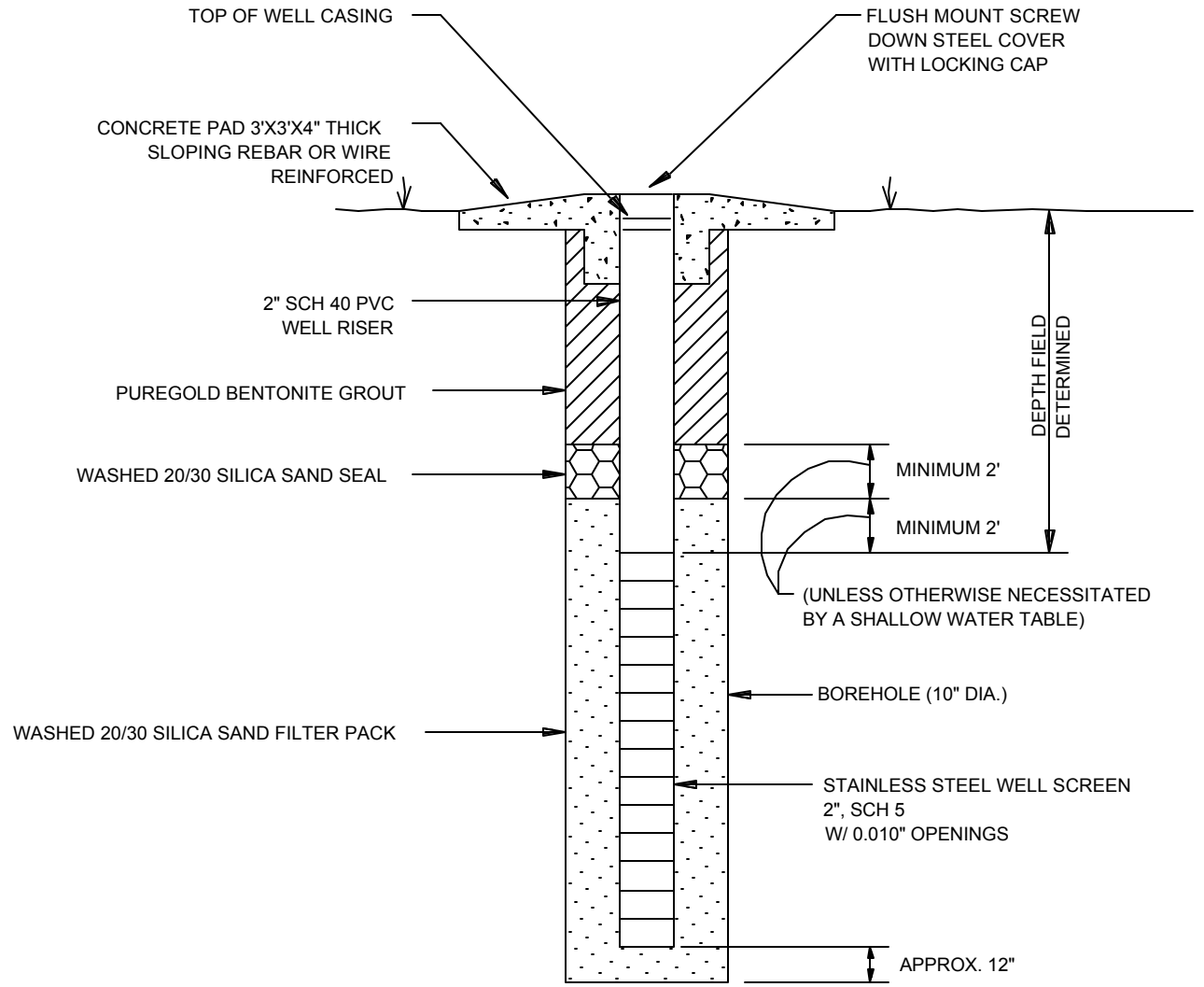
KENNESAW, GA

DATE:	Jan-14	SCALE:	NTS
PROJECT NO.	GR4997	FILE NO.	4997F005
DOCUMENT NO.		FIGURE NO.	3

CAD DWG. NO. WELLSPEC  
 CREATION DATE: 2-13-01  
 DRAFTERS INITIALS: AG

ORIGINAL DWG SIZE:  
 8.5 X 11  
 PLOT SCALE: NTS

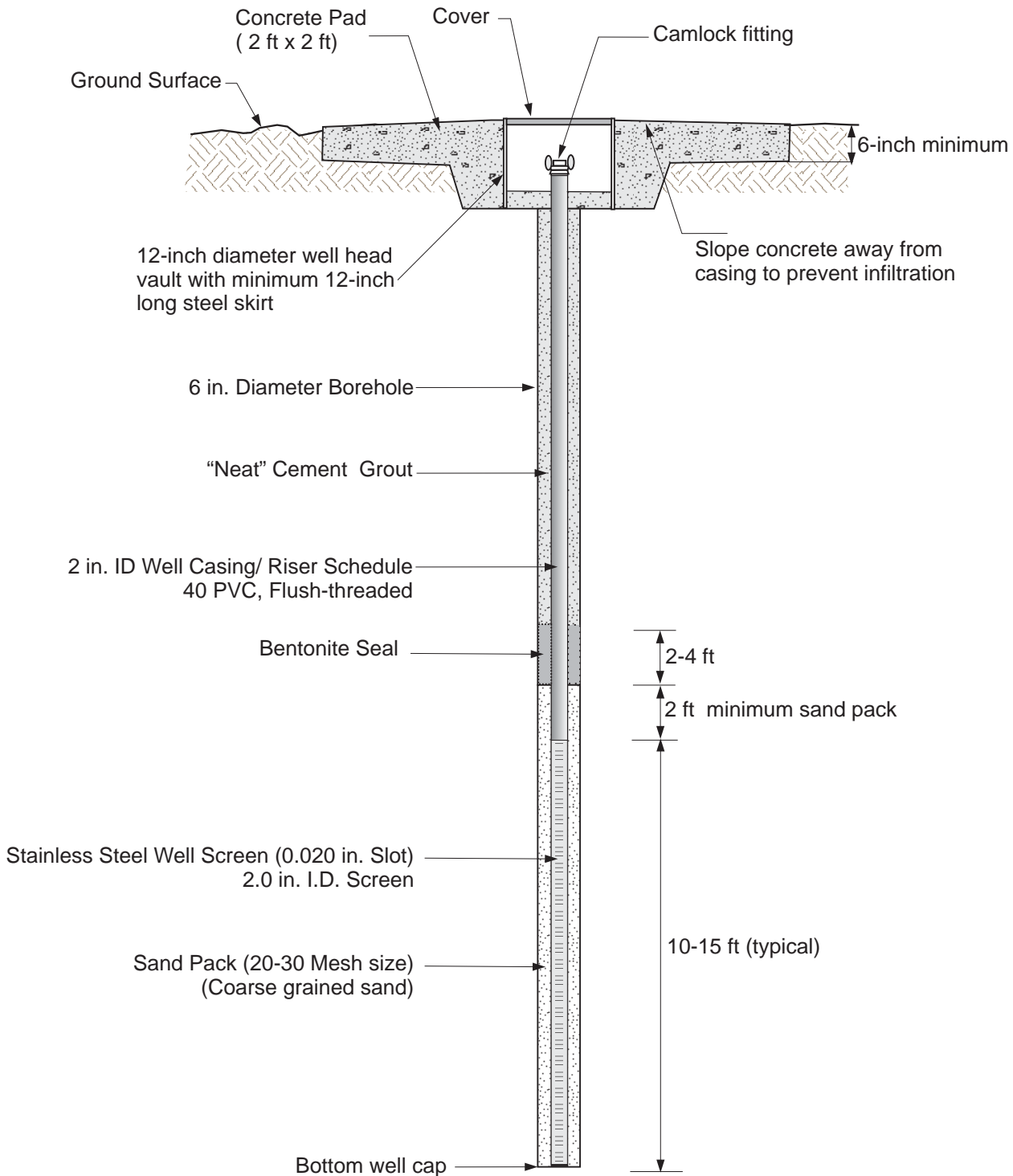
MOST RECENT REVISION:  
 REVISION DATE: 8-15-03  
 DRAFTERS INITIALS: DVP



FLUSH MOUNT WELL CONSTRUCTION DETAIL

FIGURE 4

# TYPICAL INJECTION WELL CONSTRUCTION



**Note:**

1. To achieve vertical treatment of the groundwater plume within a proposed radius of treatment, individual injection wells may be installed within a cluster of two or more wells. The constructed depth and screen interval per well would be staggered relative to the other wells within a cluster. To minimize possible short-circuiting within the well cluster, wells will be horizontally spaced 5-8 feet apart, and well screens will be vertically separated a minimum of 5 feet.

**Geosyntec**

consultants

engineers | scientists | innovators

DATE: May 2014	SCALE: NTS
PROJECT NO. GR4997	FILE NAME. Injection Well
DOCUMENT NO GA140333	FIGURE NO. 3

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## Appendix D. Grass Seed Fact Sheet

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## BAHIAGRASS

### *Paspalum notatum* Flüggé

Plant Symbol = PANO2

Contributed by: USDA NRCS Plant Materials Center  
Golden Meadow, Louisiana



Johanna Pate  
USDA NRCS Alexandria, Louisiana

#### Alternate Names

bahia grass, bahia,

#### Uses

**Erosion control:** Bahiagrass is used for the NRCS conservation practices Grassed Waterway and Critical Area Planting. It is planted on critical areas such pond banks, levees, and gullies in agricultural fields.

**Turf:** This grass is suitable for low-maintenance lawns and public areas, and is recommended for infertile soils and heavy traffic areas. It is more shade tolerant than bermudagrass.

**Livestock:** Bahiagrass, with proper management, provides fair to good pasture and hay, and can be used in woodland pasture systems (silvopasture). Forage quality depends on soil fertility and grass stage of growth. Bahiagrass hay is leafy, but difficult to make because of bahiagrass' prostrate growth habit.

**Caution:** Seed heads of the cultivar 'Argentine' are often infected by ergot (*Claviceps paspali*). Pregnant mares can experience abortion problems if they eat large quantities of infected seed heads. Also, ingestion of infected seeds can produce toxic effects in cattle. The occurrence of toxic seed heads can be managed through mowing or by keeping pregnant horses confined.

**Wildlife:** Bahiagrass can be grown with other species that are more beneficial for wildlife. Deer, birds and small mammals will utilize the plant—especially the seeds—for food.

#### Status

Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status (e.g. threatened or endangered species, state noxious status, and wetland indicator values).

#### Weediness

This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed. Please consult with your local NRCS Field Office, Cooperative Extension Service office, or state natural resource or agriculture department regarding its status and use. Weed information is also available from the PLANTS Web site at [plants.usda.gov](http://plants.usda.gov). Please consult the Related Web Sites on this species' Plant Profile for further information.

#### Description and Adaptation

Bahiagrass is a deep-rooted perennial adapted to a wide range of soils. It is low-growing and spreads with stolons and stout, scaly rhizomes. Stolons are pressed firmly to the ground, have short internodes, and root freely from the nodes forming a dense sod. Bahiagrass is a prolific seed-producing plant. The flat, tough-textured leaves are usually hairless; with blades 1/8-1/4 inch wide and 8-20 inches in length. Leaves are flat, folded, and in-rolled, tapering to a fine point. Stems usually reach 8-30 inches tall. The seed head usually consists of a dual racemes with each attached to the top of a slender stem. Occasionally there may be a third seed head present below the terminal ones.

Bahiagrass is most productive on sandy soils with a pH of 5.5 to 6.5. It is more productive on drought prone, sandy soils with relative low fertility than other forages.

**Distribution:** Bahiagrass is a native to South America. Its current range in Central and South America extends from Mexico to northern Argentina and the West Indies. It was introduced to the southeastern United States primarily for forage, and erosion control and has since become naturalized. It is adapted from east Texas to the Carolinas to as far north as northern Arkansas. Please consult the Plant Profile page for this species on the PLANTS Web site.

## Establishment

Bahiagrass can be established from seed or sod. It will grow on soils too poorly-drained for bermudagrass. The best time to establish bahiagrass is during the spring or early summer months when adequate moisture is available. Later plantings in the summer have severe competition from weeds. Fall plantings may be used in southern areas where cold temperatures are not a problem. Proper site preparation before planting is critical to ensure successful establishment. Bahiagrass should not be planted on high-pH soils (> 6.5). For pasture or hay, drill 15 pounds pure live seed (PLS) per acre at 1/4 inch depth or less. For turf, use 5-10 pounds PLS per 1000 square feet. Good seed to soil contact is essential for bahiagrass to germinate. Bahiagrass seed is slow to germinate and may take several months to fully establish. Grazing is not recommended during establishment because seedlings will be trampled and damaged. Crabgrass (*Digitaria* spp.) may become a problem on newly seeded fields. Mowing may be necessary to prevent the crabgrass from shading the bahiagrass seedlings.

## Management

Bahiagrass is a relatively low maintenance grass with fewer disease and insect problems than some of the other introduced warm season grasses. Its ability to survive periods of drought makes it adaptable for southern pastures. Bahiagrass will persist in pastures with a low level of management. Though it responds to fertilizer applications, it does not respond to the high rates commonly used on improved bermudagrass. Bahiagrass is well adapted to sandy soils due to its tolerance of drought and low soil fertility. Bahiagrass forage is slightly lower in quality than bermudagrass. Close grazing stimulates new growth and improves forage quality.

The dense, compact sod of bahiagrass inhibits the growth of intercropped legumes. However, white clover (*Trifolium repens*) and winter annuals such as crimson clover (*T. incarnatum*) and arrowleaf clover (*T. vesiculosum*) can be established and grown in bahiagrass pastures and hayfields.

## Pests and Potential Problems

Mole crickets (*Scapteriscus* spp.) have been known to cause problems in established stands. The only serious disease of bahiagrass is dollar spot fungus (*Sclerotinia homoeocarpa* F.T. Benn).

## Environmental Concerns

Bahiagrass can become a pest in bermudagrass hay fields and home lawns. Use caution when moving livestock that have grazed bahiagrass pastures. Undigested seeds can be transported and deposited in other fields.

## Control

Please contact your local agricultural extension specialist or county weed specialist to learn what works best in your

area and how to use it safely. Always read label and safety instructions for each control method.

## Cultivars, Improved, and Selected Materials (and area of origin)

Common bahiagrass is a coarse-textured, light-colored bahiagrass. It has an open and sparse growth habit and is very susceptible to cold temperatures.

'Argentine' bahiagrass forms a relatively dense sod and has a dark green color, making it acceptable for lawn use. It has good insect and disease resistance. 'Argentine' winterkills more readily than 'Pensacola'.

'Pensacola' bahiagrass was released in 1944 by the Georgia Soil Conservation Service and the Florida Agriculture Experiment Station (AES). It is the most widely grown variety of bahiagrass. It has an extensive root system giving it excellent drought tolerance. It is tolerant to hot or cold temperatures. It produces an abundance of seed heads which limits its desirability for use as a lawn grass.

'Paraguay' is a short, course, narrow-leaved cultivar that produces less forage than 'Pensacola'.

'Paraguay 22' is a single selection, non-released variety chosen for its improved cold hardiness over the Paraguay types. Both types have lower cold hardiness than 'Pensacola'.

'Tifton 9' was released in 1987 by the University of Georgia and USDA-Agriculture Research Service (ARS) as an improved selection from the 'Pensacola' variety. It was developed for improved forage characteristics. It has more vigorous seedlings, longer leaves, and improved digestibility over Pensacola'.

'TifQuik' was developed to have quick seed germination and reduced hard seed. The variety also exhibits quick growth, excellent seedling vigor, and higher forage yields than 'Tifton 9'.

'UF-Riata' was developed for south Florida by the University of Florida. This variety was selected for improved cold tolerance over 'Pensacola' or 'Argentine'.

'Wilmington' is the most cold-hardy bahiagrass variety known. Released in 1971 by Mississippi AES and NRCS, it has narrow leaves of medium size, but is less productive than 'Pensacola' and 'Paraguay'.

## Prepared By

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## Species Coordinator

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Louisiana 71302

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For more information about this and other plants, please  
contact your local NRCS field office or Conservation  
District <<http://www.nrcs.usda.gov/>>, and visit the  
PLANTS Web site <<http://plants.usda.gov>> or the Plant  
Materials Program Web site <[http://plant-  
materials.nrcs.usda.gov](http://plant-materials.nrcs.usda.gov)>

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