

Wayne County  
Construction and Demolition Debris Landfill  
Permit No. 9601-CDLF-1997

460 B S. Landfill Rd.  
Dudley, NC 28333

## **Operation Plans for:**

Sorting Tear-off Asphalt Shingles for Recycling

Passive Compositing in Borrow Pit #1

Inert Debris Storage and Processing in Borrow Pit #1

Prepared by:  
Wayne County Solid Waste Department  
460 B S. Landfill Rd.  
Dudley, NC 28333

July 2013

## Sorting Tear-off Asphalt Shingles for Recycling – Operation Plan

### I. Introduction

This operation plan describes how tear-off asphalt shingles will be collected, sorted, stored, and managed at this facility in order to provide a material that can be used in paving asphalt production. All tear-off shingle handling will occur within the disposal limits of the C&D landfill. Our facility uses best practices for acceptance and sorting to remove the tear-off shingles from the waste stream and divert the “clean” shingles to other facilities. Our facility will not engage in sorting, processing, or grinding of the collected recyclable asphalt shingles.

### II. Waste Acceptance

Asphalt roofing shingles contain asphalt cement, mineral aggregate, and mineral filler, which are raw materials used in asphalt production. Asbestos was used in shingle manufacture until the mid-1970s and in other roofing materials such as roof felt, roof putty, surface coating, and mastic until the mid-1980s.

Our facility provides roofers with a list of acceptable and unacceptable items for tear-off shingle recycling and requires source separation at the job site by the roofer. Materials from flat and built-up roofing systems are disposed rather than accepted for recycling due to the higher use of asbestos roofing materials in those systems. Roofers are instructed to separate tear-off shingles into either a dedicated trailer or to layer their waste when loading so that the shingles can be easily separated from the unacceptable debris. Our list of acceptable and unacceptable material is shown in Attachment 1. Only tear-off shingles originating from Wayne County are accepted.

The shingle suppliers are also required to complete a supplier certification form. The handling and disposal of asbestos during demolition and renovation is regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP). Before work can be started at a NESHAP-regulated facility, a notification of demolition and renovation must be submitted. The notification includes an inspection by a North Carolina accredited inspector or roofing supervisor and an analysis for asbestos. The supplier of shingles from a NESHAP-regulated facility must present documentation that the shingles do not contain greater than 1% asbestos. The documentation is a letter from the accredited asbestos inspector or roofing supervisor that sampled the shingles and the analytical test results. A copy of the documentation is kept with the supplier certification form. Shingles from a NESHAP-regulated facility that do not have the required documentation or that are documented to contain greater than 1% asbestos are disposed.

Shingles from single-family homes or residential building containing four or fewer dwelling units are generally not regulated under NESHAP. Only the source of shingles is required for these shingles.

Our supplier certification form is shown in Attachment 2. These practices help ensure that only recyclable tear-off shingles are sent for asphalt production while reducing sorting at our facility.

### III. Flow and Management of Tear-off Shingles

Loads are visually inspected when entering the facility to determine whether the shingles have been separated or if it is a mixed load. The roofer is asked to complete a supplier certification form. Mixed loads, shingles from a NESHAP-regulated facility that contain greater than 1% asbestos, and shingles from a NESHAP-regulated facility without the proper documentation are directed to the C&D landfill working face for disposal.

Source-separation by the roofer eliminates most of the unacceptable materials that cannot be used in tear-off shingle recycling. Loads that were source-separated into dedicated containers are sent directly to the stockpile area and unloaded. Loads that were separated into layers usually have the shingles on the bottom and other material on the top. These loads are first directed to the C&D landfill working face to remove the non-shingle roofing waste and then to the stockpile area for unloading the shingles. The stockpiled tear-off shingles are examined for unacceptable materials and any unacceptable materials are removed. If unacceptable C&D material is placed in the stockpile area, the landfill equipment operator immediately removes that material and disposes it in the C&D landfill working face. If other unacceptable material is discovered in the stockpile area, the material is handled in accordance with the C&D landfill's "Waste Screening Plan" (Appendix C of the Operation Plan, Doc. ID 16639, revised through May 2012). Any unacceptable waste is removed and disposed properly at the end of each working day.

No additional traffic controls are needed because the shingle stockpile area will always be located in close proximity to the C&D working face. Vehicles, regardless of whether they have C&D or source-separated shingles, are all directed to follow the signage to the C&D landfill. Signs indicate the location of the shingle stockpile area. A landfill equipment operator is always present to provide unloading instructions and traffic direction.

The remaining sorted shingles are accumulated in the stockpile area until there is a sufficient amount to transport to a facility that will grind and use or sell the ground shingles for asphalt production. At least 75% of the tear-off shingles that are stockpiled leave the facility during the same year.

#### IV. Stockpile Details

A sign identifies the shingle stockpile area. It is also marked by highly-visible cones. The stockpile area has dimensions of approximately 20' X 20', which is 400 square feet. A maximum of 24 tons of shingles are stockpiled at any given time. Shingles are not stockpiled in an area with standing water. The shingle stockpile area will always be located in close proximity to the C&D landfill working face. The stockpile area is close to the C&D landfill working face so that in the event the sorted material is unable to be recycled, the material can be easily pushed into the working face for disposal. The working face will move as phases of the C&D landfill are filled, and the shingle stockpile will move after each phase is filled. Due to variability of waste receipts, we are unable to provide an exact frequency at which the stockpile will be relocated. Our current estimate is that the stockpile will be relocated once or twice a year. Attachment 3: Figure 1 shows the location of the stockpile area.

#### V. Gas Collection System Concerns

Shingle and C&D placement activities will be conducted in accordance with Section 1.5 Landfill Gas Collection System of the Operation Plan (Doc. ID 16639, revised through May 2012). Gas collection system components are marked by high-visibility flags and protected by concrete barriers. Shingle and C&D placement will not impact the integrity of the landfill gas collection system.

#### VI. Recordkeeping

Records are kept of shingles entering the facility, sorted shingles leaving the facility for recycling, and waste that is disposed. These records are kept for use in the facility's monthly and annual reports. Supplier certification forms and any supporting documents are also kept.

#### VII. Contracting Company

Barnhill Contracting Company purchases and hauls the stockpiled shingles off-site. Our facility contacts them when the amount of stockpiled shingles reaches a sufficient load size. Our facility uses a loader or an excavator to load shingles into the contractor's hauling vehicle. Approximately 12 tons of shingles constitutes a load. The Barnhill Contracting Company and/or the facility that processes or grinds the recyclable asphalt shingles is responsible for conducting required asbestos sampling and testing prior to processing or grinding the recyclable shingles. Barnhill Contracting Company's contact information is:

Barnhill Contracting Company  
PO Box 399  
Kinston, NC 28502  
(252) 527-8021

## Passive Compositing in Borrow Pit #1 – Operation Plan

### I. Introduction

This operation plan describes how passive compositing will be conducted in a designated area within Borrow Pit #1. This area is outside the disposal limits of the C&D landfill. All waste placement and management activities will be conducted by landfill employees only. The general public will not have access to this area. Material resulting from this passive compositing will only be used by the Wayne County Solid Waste Department for use as a soil amendment in daily and intermediate landfill cover. Material will not be given to or sold to the general public. Composting as it is described in and regulated by 15A NCAC 13B, Section .1400 is not conducted in this area.

### II. Waste Streams

"Yard waste" and "land clearing waste" are managed in this area. "Yard waste" by definition means "Yard Trash" and "Land-clearing Debris" as defined in G.S. 130A-290, including stumps, limbs, leaves, grass, and untreated wood. "Yard trash" means solid waste resulting from landscaping and yard maintenance such as brush, grass, tree limbs, and similar vegetative material. "Land clearing debris" means solid waste which is generated solely from land clearing activities. "Land clearing waste" means solid waste which is generated solely from land clearing activities such as stumps, trees, limbs, brush, grass, and other naturally occurring vegetative material. Only material generated within Wayne County is accepted.

### III. Material Management

Scales are used to weigh incoming loads of yard waste and land clearing waste. Customers deposit yard waste and land clearing waste in a roll-off container at our facility's Recycling Collection Center, which is located on the east side of the scale house as shown on Drawing No. F1/Sheet 3 of 9 in the C&D Landfill Operation Plan (Doc. ID 16639, revised through May 2012).

Landfill employees remove the roll-off container once it is full, weigh the load, and dump the material in the passive compositing area. Landfill employees then remove any solid waste or C&D that may be incidentally deposited in the area and dispose it properly by the end of each working day. If other unacceptable material is discovered in the stockpile area, the material is handled in accordance with the C&D landfill's "Waste Screening Plan" (Appendix C of the Operation Plan, Doc. ID 16639, revised through May 2012).

Landfill employees use heavy machinery to arrange the material into windrows. Green wastes (grass and leaves) and trunks/limbs/untreated wood are separately stockpiled initially. Periodically, and at least annually, the windrows will be turned

using an excavator and/or a loader. Then, it is estimated that a useable product will be produced after two years of this minimal processing.

3,500 tons of yard waste and land clearing waste will be placed in this area per year. This amount translates to 875 tons of material per quarter. Because passive composting is the only processing applied to the storage pile, we are unable to determine the amount of processed material that will be removed from the area on a quarterly basis. It is estimated that a minimum of two years of passive composting will be needed to render a usable product. Records are kept of the amount of material placed in the passive composting area and of the amount of material used for cover. These records are kept for use in the facility's monthly and annual reports.

Attachment 3: Figure 1 shows the location of the passive composting area. The area is restricted to 0.94 acres. The unit is at least 50 feet away from water bodies, the LCIDLF, and other waste management units.

Adequate erosion control measures, structures, or devices will be utilized to prevent silt from leaving the site and to prevent excessive on-site erosion. Storm water runoff is controlled by Riser Basin #1 as described in the attached Erosion and Sedimentation Control Plan (Attachment 4). Access roads to and from the unit are maintained for use in all weather conditions.

#### IV. Fire Prevention and Control

Our facility has a water wagon and fire extinguishers on-site. Emergency procedures and emergency responder information are located in the C&D landfill's *Operation Plan* (Doc. ID 16639, revised through May 2012) and fire emergencies in this yard waste and land clearing waste management area will be handled in accordance with that plan.

To prevent fires, the windrows will be limited to 12 feet in height and 10 feet in width. A minimum of 25 feet will be kept between windrows. Piles will be turned during periods of precipitation, which will also help with odor control and provide needed moisture to the material.

## **Inert Debris Storage & Processing in Borrow Pit #1 – Operation Plan**

### **I. Introduction**

This operation plan describes how inert debris will be stored and processed into usable aggregate in a designated area within Borrow Pit #1. All waste placement and management activities will be supervised and/or conducted by Wayne County Solid Waste employees. The general public will not have access to this area. Processed material will be used for road material at the Wayne County Landfill only. The storage and processing activities in this area involve neither excavation nor filling.

### **II. Waste Streams**

Inert debris is stored and processed in this area. The material consists solely of concrete, brick, concrete block, uncontaminated soil, gravel and rock. Only material generated within Wayne County is accepted.

### **III. Material Management**

Customers with inert debris typically notify the weigh-master that they have inert debris when they arrive on the scales. At this time the landfill operations supervisor is notified that a load of inert debris has arrived. The supervisor examines the load while it is in the hauling vehicle and determines if the material is eligible for placement in the inert debris area. The supervisor escorts the customer to the inert debris storage area and supervises unloading of the debris. Attachment 3: Figure 1 shows the location of the inert debris storage area (also known as the concrete recycling area).

The supervisor immediately removes any solid waste or C&D that may be incidentally deposited in the inert debris area and disposes it properly by the end of each working day. If other unacceptable material is discovered in the storage area, the material is handled in accordance with the C&D landfill's "Waste Screening Plan" (Appendix C of the Operation Plan, Doc. ID 16639, revised through May 2012).

Adequate erosion control measures, structures, or devices will be utilized to prevent silt from leaving the site and to prevent excessive on-site erosion. Storm water runoff is controlled by Riser Basin #1 as described in the attached Erosion and Sedimentation Control Plan (Attachment 4). Access roads to and from the unit are maintained for use in all weather conditions.

A maximum of 4,000 tons of unprocessed material is stored in this area. Records are kept on the amount of material stored and processed for use in the facility's

monthly and annual reports. The pile's area is restricted to 0.38 acres. The unit is at least 50 feet away from water bodies, the LCIDLF, and other waste management units.

#### IV. Contracting Company

Best Sand & Gravel Inc. is contacted when our facility determines that there is sufficient stockpiled material. Best Sand & Gravel Inc. brings a crusher and conveyor belt with a scale to the site and processes the material into aggregate. Their contact information is:

Best Sand & Gravel Inc.  
2390 NC 111 South  
Goldsboro, NC 27534  
(919) 778-3252

Attachment 1

## TEAR-OFF ASPHALT SHINGLE RECYCLING

### List of Acceptable and Unacceptable Materials

#### "YES"

##### Include these items:

- Shingles
- Felt attached to shingles

#### "NO"

##### Do NOT include these items:

- Wood
- Metal flashings, gutters, etc.
- Nails (best effort)
- Rolls of sheets of felt paper
- Plastic wrap, buckets
- Paper waste
- No garbage, trash, or other waste materials
- Built-up asphalt roofing
- Asbestos-containing materials
- Shingles containing mastics

## Attachment 2

**Wayne County Landfill**  
**SHINGLE SUPPLIER CERTIFICATION FORM**

**Supplier of Whole Tear-off Asphalt Shingles**

Supplier Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Contact Name: \_\_\_\_\_  
Phone: \_\_\_\_\_

**We the undersigned certify that (check appropriate boxes):**

The tear-off shingles are from a NESHAP regulated facility and documentation stating that the shingles do not contain >1% asbestos is attached. (Documentation is a letter from the North Carolina accredited asbestos inspector or roofing supervisor that collected the samples with the analytical results attached.)

The tear-off shingles are from a single family home or residential building having four or fewer dwelling units that is not regulated under NESHAP.

**Tear-off shingles were removed from the following addresses:**

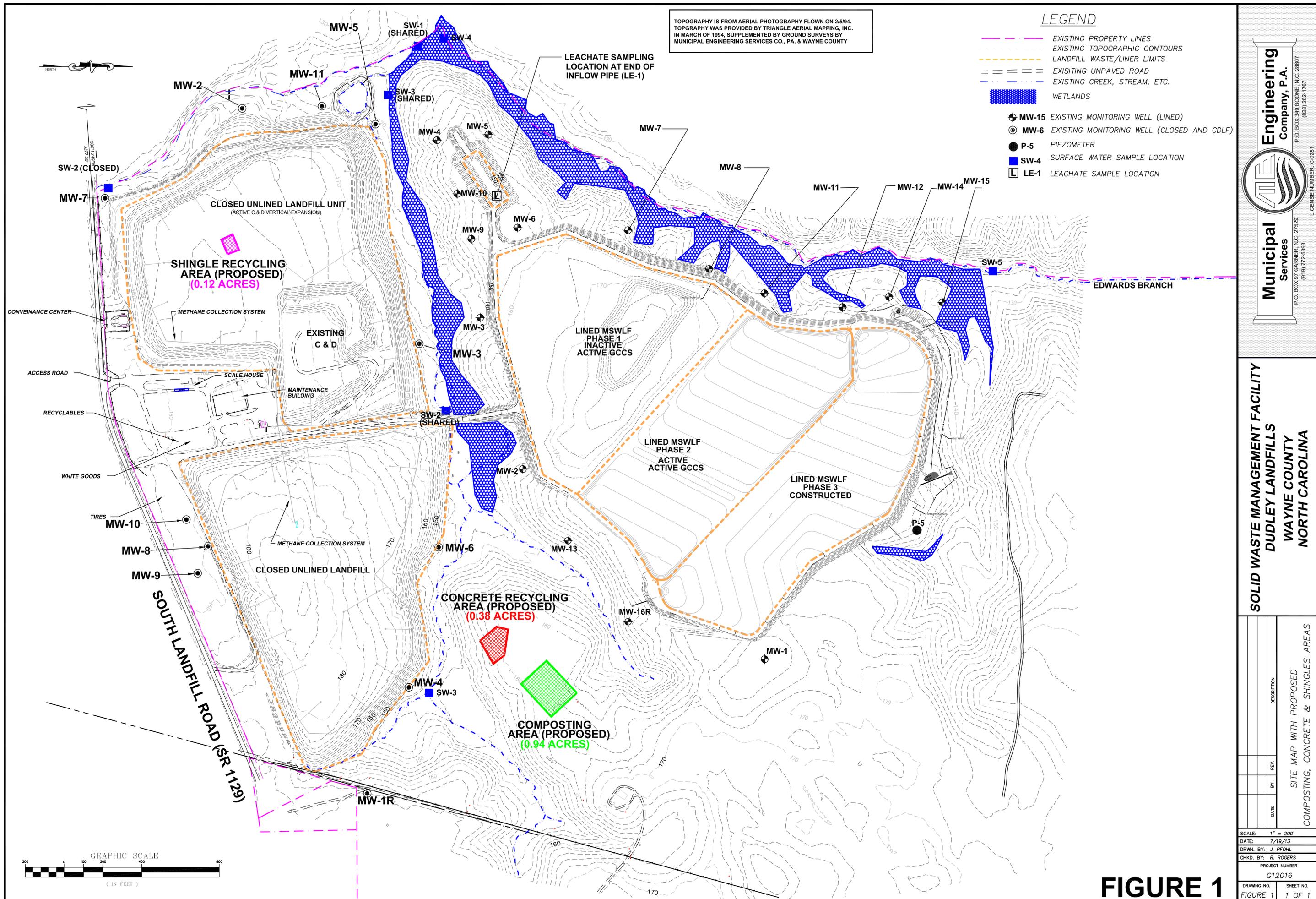
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(Please attach additional sheets as needed to record each building address.)

\_\_\_\_\_  
Shingle Supplier (signature)

\_\_\_\_\_  
Date

## Attachment 3



**Engineering Company, P.A.**  
 P.O. BOX 349 BOONE, N.C. 28607  
 (828) 262-1767  
 License Number: C-0281

**Municipal Services**  
 P.O. BOX 97 GARNER, N.C. 27529  
 (919) 772-5393

**SOLID WASTE MANAGEMENT FACILITY  
 DUDLEY LANDFILLS  
 WAYNE COUNTY  
 NORTH CAROLINA**

DATE	BY	REV.	DESCRIPTION
			SITE MAP WITH PROPOSED COMPOSTING, CONCRETE & SHINGLES AREAS

SCALE:	1" = 200'
DATE:	7/19/13
DRWN. BY:	J. FOHL
CHKD. BY:	R. ROGERS
PROJECT NUMBER:	G12016
DRAWING NO.:	FIGURE 1
SHEET NO.:	1 OF 1

**FIGURE 1**

Attachment 4



Original to Lisa Hampton  
Copy to Wayne Sullivan

State of North Carolina  
Department of Environment and Natural Resources  
Washington Regional Office

Michael F. Easley, Governor

William G. Ross, Jr., Secretary

DIVISION OF LAND RESOURCES  
LAND QUALITY SECTION

April 15, 2002

LETTER OF APPROVAL OF REVISED PLAN

County of Wayne  
ATTN: Mr. W. Lee Smith, III, Manager  
Post office Box 227  
Goldsboro, North Carolina 27533

RE: Erosion and Sedimentation Control Plan No. Wayne-2002-041  
Landfill Borrow Sites #1 & #2  
SR 1129 - Wayne County  
River Basin: Neuse  
Date Received: April 4, 2002  
Responsible Party: County of Wayne



Dear Sir:

This office has completed its review of the revised erosion and sedimentation control plan for the referenced 39.0 acre disturbance. Based on the information provided, we have determined the submitted plan for the excavation of 2 on-site borrow pits to provide material for proper operation of a solid waste landfill, if properly implemented and responsibly maintained, should meet the intent and minimum requirements of the Act. We, therefore, issue this LETTER OF APPROVAL.

In 1973, the Sedimentation Pollution Control Act (copy available upon request) was enacted. It established a performance oriented program with the OBJECTIVE of PREVENTING SEDIMENT DAMAGE to adjoining properties and/or natural resources resulting from land disturbing activities through the use of reasonable and appropriate Best Land Management Practices, based on the approved plan and changing site conditions, during the course of the project. **AS THE DECLARED RESPONSIBLE PARTY YOUR RESPONSIBILITY** is to understand the Act and comply with the following minimum requirements of the Act and the above listed modifications (if any):

- *an erosion and sedimentation control plan is only valid for 3 years following the date of initial approval, if no land-disturbing activity has been undertaken;*

- *the LATEST APPROVED soil erosion and sediment control plan will be used during inspection to determine compliance and a copy of the plan must be on file at the job site;*
- *except in the case of a storm related emergency, a revised erosion and sedimentation control plan must be submitted to and approved by this office prior to initiating any significant changes in the construction, grading or drainage plans;*
- *a buffer zone, sufficient to restrain visible sedimentation, must be provided and maintained between the land-disturbing activity and any adjacent property or watercourse;*
- *new or affected cut or filled slopes must be at an angle that can be retained by vegetative cover, AND must be provided with a ground cover sufficient to restrain erosion within the shorter of 15 working or 30 calendar days of completion of any phase (rough or final) of grading (RYE GRASS IS NOT in the APPROVED seeding specifications NOR is it an ACCEPTABLE substitute for the providing of a temporary ground cover);*
- *the CERTIFICATE OF PLAN APPROVAL must be posted at the primary entrance to the job site and remain until the site is permanently stabilized;*
- *unless a temporary, manufactured, lining material has been specified, a clean straw mulch must be applied, at the minimum rate of 2 tons/acre, to all seeded areas. The mulch must cover at least 75% of the seeded area after it is either tacked, with an acceptable tacking material, or crimped in place;*
- *in order to comply with the intent of the Act, the scheduling of the land-disturbing activities is to be such that both the area of exposure and the time between the land disturbance and the providing of a ground cover is minimized;*
- *a permanent ground cover, sufficient to restrain erosion, must be provided within the shorter of 15 working or 90 calendar days after completion of construction or development on any portion of the tract (RYE GRASS IS NOT in the APPROVED seeding specifications NOR is it an ACCEPTABLE substitute for the providing of a nurse cover for the permanent grass cover); and,*

County of Wayne  
ATTN: Mr. W. Lee Smith, III, Manager  
April 15, 2002  
Page 3

- *this approval is based, in part, on the accuracy of the information provided in the Financial Responsibility/Ownership form submitted with the project plans. You are required to file an amended form if there is any change in the information included on the form. This approval and the financial responsibility/liability cited in it does not automatically transfer with a change in project ownership.*

Be advised that to ensure compliance with the approved plan and the program requirements, unannounced periodic inspections will be made. If it is determined that the implemented plan is inadequate, this office may require the installation of additional measures and/or that the plan be revised to comply with state law. (Note: Revisions to the scope of this project without prior approval of the plan showing the changes can be considered a violation). Failure to comply with any part of the approved plan or with any requirements of this program could result in the taking of appropriate legal action against the financially responsible party (*County of Wayne*). One option is the assessing of a civil penalty of up to \$5000 for the initial violation plus up to \$5000 per day for each day the site is out of compliance.

In recognizing the desirability of early coordination of sedimentation control, we believe it would be beneficial for you and your contractor to arrange a preconstruction conference to discuss the requirements of the approved erosion and sedimentation control plan. Prior to beginning this project, **YOU ARE REQUIRED TO** either **CONTACT THIS OFFICE TO ADVISE** Mr. Richard Peed (252-946-6481, ext. 274) **OF THE CONSTRUCTION START-UP DATE**, contractor and on-site contact person OR complete and return the attached Project Information Sheet to the above named.

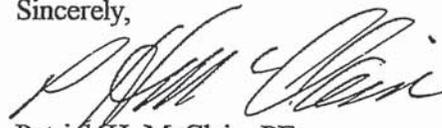
Acceptance and approval of this plan is conditioned upon your compliance with Federal and State water quality laws, regulations and rules. In addition, the land disturbing activity described in this plan may also require approval or permitting from other agencies - Federal, State or local. These could include the U.S. Army Corps of Engineers under Article 4.0.4. jurisdiction, the Division of Water Quality - Surface Water Section under stormwater regulations (contact Mr. Bill Moore, 252-946-6481, ext. 264), county, city or town agencies under other local ordinances, or other approvals that may be required. **This approval does not supersede any other approval or permit.**

Please be advised that a rule to protect and maintain existing buffers along watercourses in the Neuse River Basin became effective on July 22, 1997. The Neuse River Riparian Area Protection and Maintenance Rule (15A NCAC 2B.0233) applies to a 50 (horizontal) foot wide zone along all perennial and intermittent streams, lakes, ponds and estuaries in the Neuse River basin. In riparian areas, the rule prohibits land disturbance, new development and fertilizer use in the first 30 (horizontal) feet directly adjacent to the stream and/or coastal wetland vegetation. Clearing, seeding and a one-time fertilizer use to establish the grass is allowed within the riparian area 20 feet landward of the first 30 feet of riparian area, but new development is prohibited. For more information about the riparian area rule, please contact the Division of Water Quality's Wetland/401 Unit at 919-733-1786.

County of Wayne  
ATTN: Mr. W. Lee Smith, III, Manager  
April 15, 2002  
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Please be advised that all land-disturbing activities affecting 5 or more acres are required to have a NPDES permit. Enclosed is the Construction Activities General NPDES Permit - NCG010000 for this project. The responsibility for understanding and complying with this permit rests with you. Contact the Division of Water Quality - Surface Water Section at (252) 946-6481 should you have any questions regarding monitoring and record keeping requirements of the permit.

Sincerely,



Patrick H. McClain, PE  
Assistant Regional Engineer

:pm

enclosures

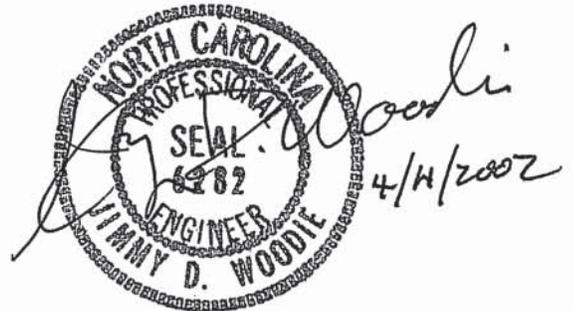
w/o enc. cc: ✓ Jimmy D Woodie, PE, Municipal Engineering  
(via e-mail) Jim Mulligan, Division of Water Quality

# **REVISED EROSION CONTROL PLAN**

**FOR THE**

## **WAYNE COUNTY MUNICIPAL SOLID WASTE LANDFILL FACILITY BORROW SITES**

**PROJECT NO.  
G02039**



*Rev. April 2002  
February 2002*

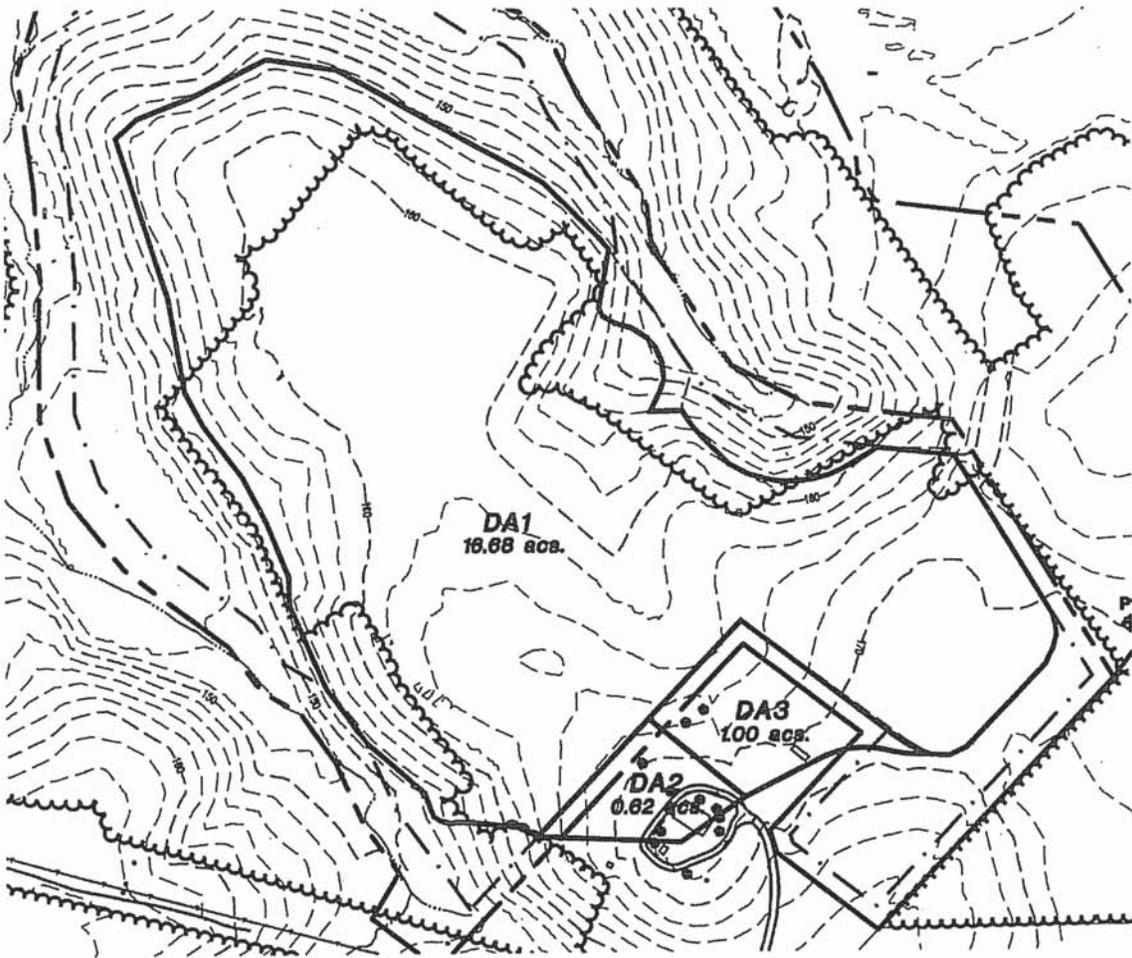
*Municipal Engineering Services Co., PA  
Garner and Boone, North Carolina*

# DRAINAGE AREAS BORROW SITE #1

Area Designation	Area (ac.)
DA1	16.68
DA2	0.62
DA3	1.00

**Rainfall Intensity**  
 $i = 7.4$

**Runoff Coefficient**  
 $C = .25$



**Areas Draining Into Riser Basin #1**

Area	A	I	C
DA1	=16.68 acs.	7.4 in/hr.	.25
DA2	=0.62 acs.	7.4 in/hr.	.25
DA3	=1.00 acs.	7.4 in/hr.	.25
<hr/>			
	= 18.30 acs.	7.4 in/hr.	.25

$$Q_{(10)} = CIA = (.25)(7.4)(18.30) = 33.86 \text{ cfs.}$$

**DESIGN RISER BASIN #1**

$$Q = 33.86 \text{ cfs}$$

$$A = 18.30 \text{ acs.}$$

Surface area of riser basin:

$$\text{Surface area } S = .01Q \quad S = (.01)(33.86) = 0.3386 \text{ acs.}$$

$$S = 0.3386 \times 43560 \text{ ft}^2 = 14,749 \text{ ft}^2$$

Depth of riser basin:

$$\text{depth} = \text{Capacity/surface area}$$

Capacity needed is 1800 ft<sup>3</sup>/acre.

$$\text{Capacity} = (1800)(18.30) = 32,940 \text{ ft}^3.$$

Due the location and the shape of the basin, the average end method of calculating the storage of the basin is as follows:

$$\text{bottom area elevation } 148 \quad = 126,708$$

$$\frac{1}{2} \text{ riser height } 150 \quad = 313,369$$

therefore:

$$126,708 + 313,369 = (440,077 \div 2) 2' = 440,077 \text{ ft}^3$$

The actual storage capacity of the basin is adequate to contain the runoff.

Principal spillway barrel size:

Use Capacity of 0.2 cfs/acre  
 $Q = (18.30)(.2) = 3.66$  cfs  
1.5% grade

$D = 16 (Q n \div \sqrt{s})^{.375}$  Use corrugated metal pipe

$Q = 3.66$  cfs     $n = .024$          $s = .015$

$D = 16[(3.66)(.024) \div \sqrt{.015}]^{.375} = 14.12$ " Use 18" pipe diameter

Outlet Protection

$L = 24'$     $W = 25.5'$     $d_{50} = 13"$    29.25" min. thickness

Riser pipe for Principal spillway:

1.5 times the barrel =  $1.5 \times 14.12 = 21.18$ "  
use 30" pipe diameter

Footing for riser pipe:

Weight of water:  $\pi r^2 h (62.4) = 1,960$     given:  $r = 1.25'$     $h = 4'$

Concrete: 150 lbs per  $ft^3$

13.07  $ft^3$  of concrete needed

use 16  $ft^3$  of concrete

1'x4.0'x4.0' footing.

Emergency Spillway:

$Q = C_W L H^{3/2}$     $C_W = 3.0$     $H = 1$     $Q = 33.85$

$L = Q \div (C_w)(H^{3/2}) = 33.85 \div (3)(1^{3/2}) = 11.28'$  Required

Bottom of Weir = 12'

Top of Weir = 21'

Line with 9" Rip Rap

Elevations:

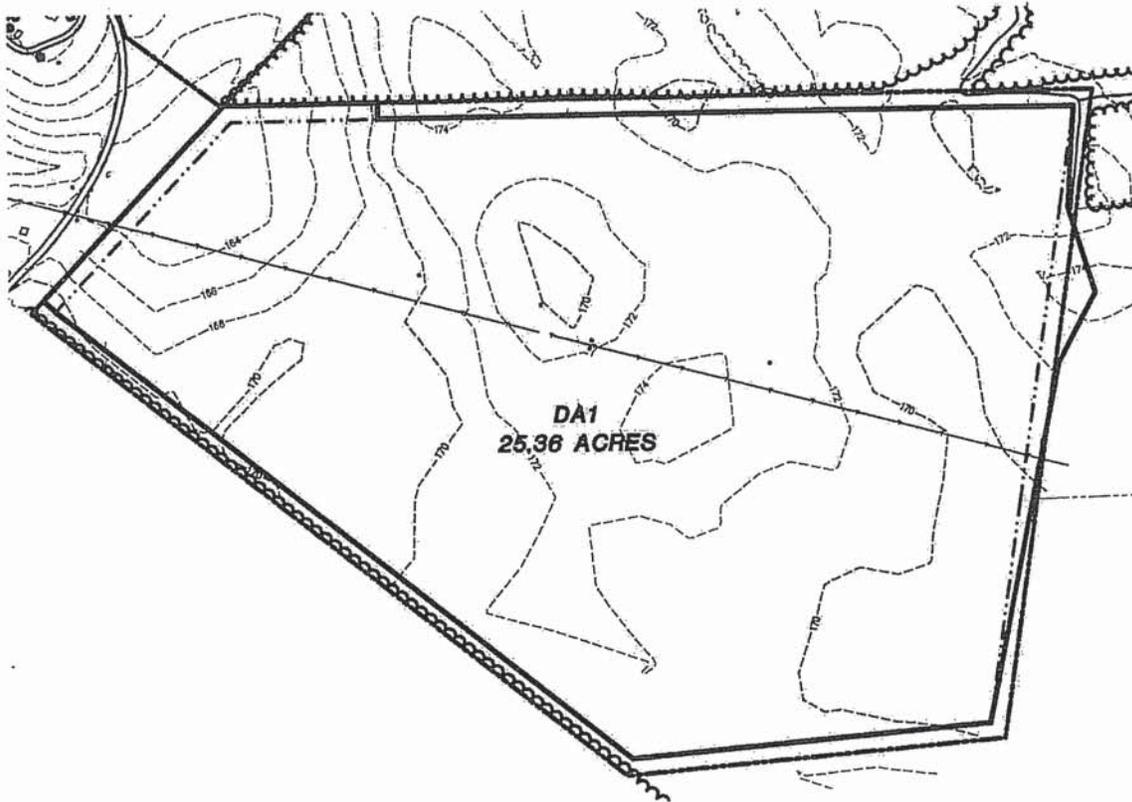
Top of Dam	154.0'
Emergency Spillway	152.5'
Riser Crest	152.0'
Conduit Inlet	148.0'
Conduit Outlet	147.5'
Bottom Elevation	148.0'

**DRAINAGE AREAS BORROW SITE #2**

Area Designation	Area (ac.)
DA1	25.36

**Rainfall Intensity**  
 $i = 7.4$

**Runoff Coefficient**  
 $C = .25$



**Areas Draining Into Riser Basin #1**

<u>Area</u>	<u>A</u>	<u>I</u>	<u>C</u>
DA1	=25.36 acs.	7.4 in/hr.	.25

$Q_{(10)} = CIA = (.25)(7.4)(25.36) = 46.92 \text{ cfs.}$

**DESIGN RISER BASIN #1**

Q = 46.92 cfs  
A = 25.36 acs.

Surface area of riser basin:

$$\begin{aligned} \text{Surface area } S &= .01Q \quad S = (.01)(46.92) = 0.4692 \text{ acs.} \\ S &= 0.4692 \times 43560 \text{ ft}^2 = 20,439 \text{ ft}^2 \end{aligned}$$

Depth of riser basin:

$$\text{depth} = \text{Capacity/surface area}$$

Capacity needed is 1800 ft<sup>3</sup>/acre.

$$\text{Capacity} = (1800)(25.36) = 45,648 \text{ ft}^3.$$

Due the location and the shape of the basin, the average end method of calculating the storage of the basin is as follows:

bottom area elevation	164	=	979,569
½ riser height	166	=	995,850

therefore:

$$979,569 + 995,850 = (1,975,419 \div 2) 2' = 1,975,419 \text{ ft}^3$$

The actual storage capacity of the basin is adequate to contain the runoff.

Principal spillway barrel size:

Use Capacity of 0.2 cfs/acre  
 $Q = (25.36)(.2) = 5.07$  cfs  
0.5% grade

$D = 16 (Q n \div \sqrt{s})^{.375}$  Use corrugated metal pipe

$Q = 5.07$  cfs     $n = .024$          $s = .005$

$D = 16[(5.07)(.024) \div \sqrt{.005}]^{.375} = 19.61$ "(required min.) Use 24" pipe diameter

Outlet Protection

$L = 24'$      $W = 26'$      $d_{50} = 11"$     24.75" min. thickness

Riser pipe for Principal spillway:

1.5 times the required min. barrel size =  $1.5(19.61") = 30$ " pipe diameter

Footing for riser pipe:

Weight of water:  $\pi r^2 h(62.4) = 1,960$         given:  $r = 1.25'$      $h = 4'$

Concrete: 150 lbs per  $ft^3$

13.07  $ft^3$  of concrete needed

use 16  $ft^3$  of concrete

1'x4.0'x4.0' footing.

Emergency Spillway:

$Q = C_W L H^{3/2}$      $C_W = 3.0$      $H = 1$      $Q = 46.92$

$L = Q \div (C_w)(H^{3/2}) = 46.92 \div (3)(1^{3/2}) = 15.64'$  Required

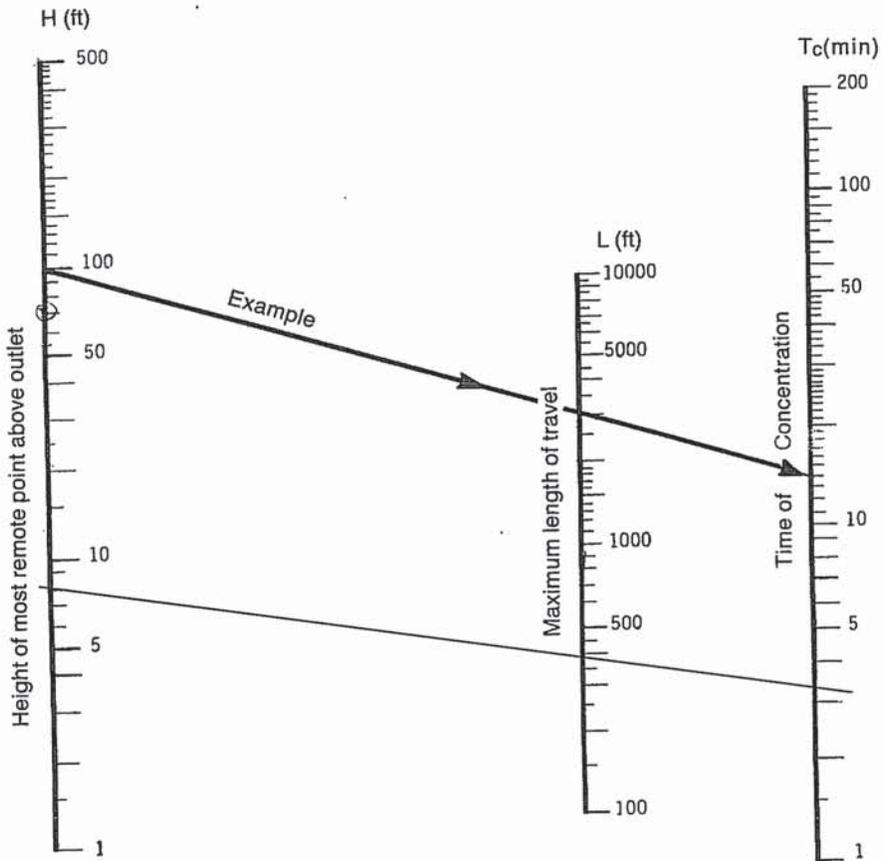
Bottom of Weir = 16'

Top of Weir = 25'

Line with 6" Rip Rap

Elevations:

Top of Dam	170.0'
Emergency Spillway	168.5'
Riser Crest	168.0'
Conduit Inlet	164.0'
Conduit Outlet	163.5'
Bottom Elevation	164.0'



Note:  
Use nomograph  $T_c$  for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply  $T_c$  by 2.

For overland flow, concrete or asphalt surfaces, multiply  $T_c$  by 0.4.

For concrete channels, multiply  $T_c$  by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

8.03.4

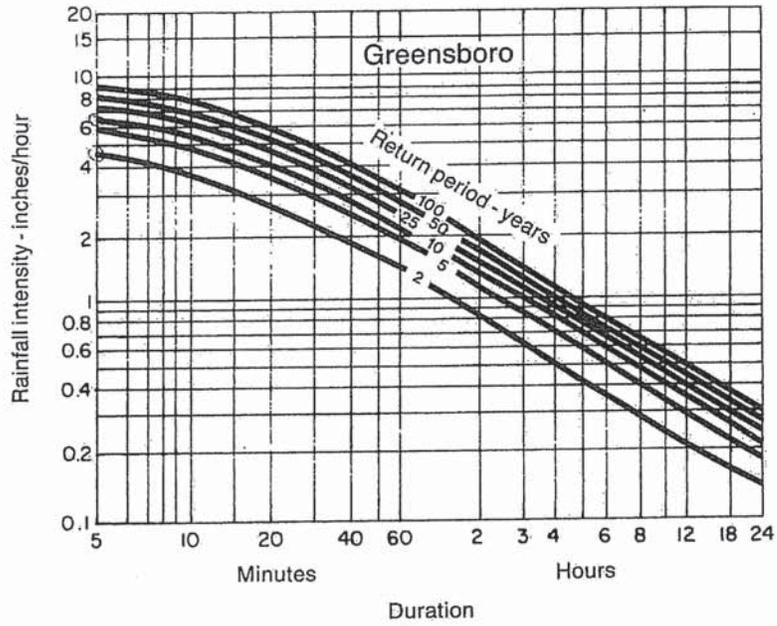


Figure 8.03d Rainfall intensity duration curves—Greensboro

USE THIS ONE

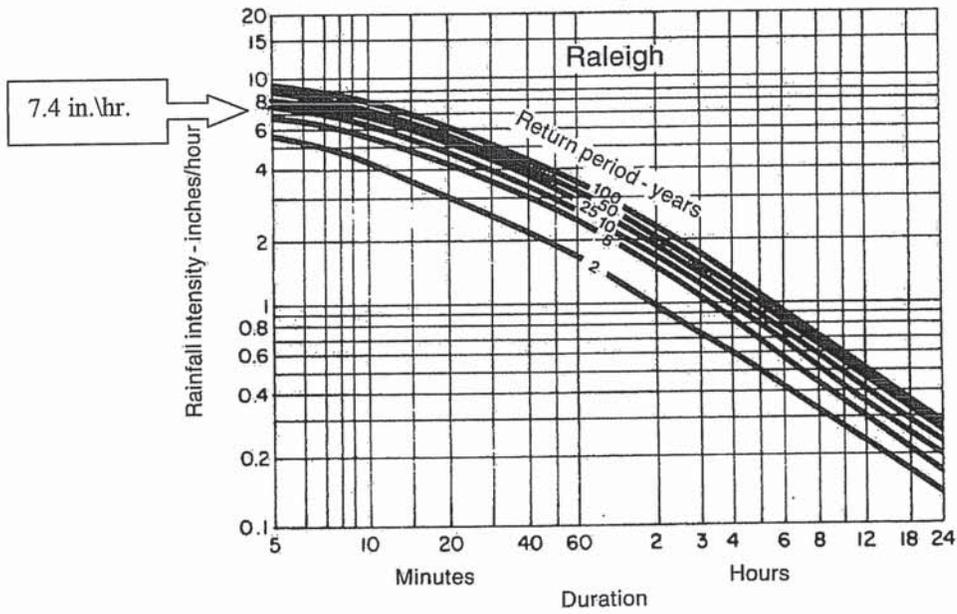
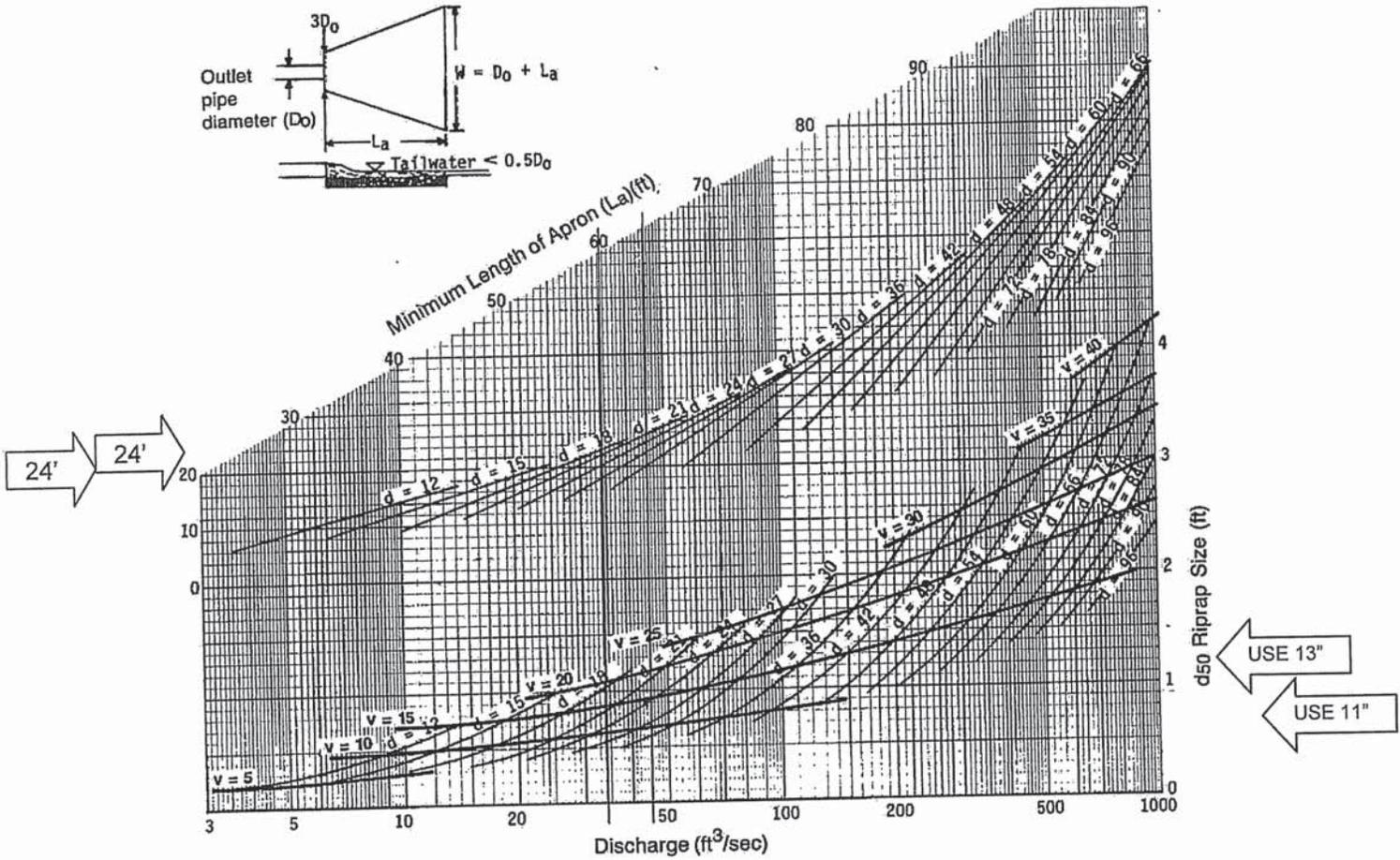


Figure 8.03e Rainfall intensity duration curves—Raleigh.

8.03.6



Curves may not be extrapolated.

Figure 8.06a Design of outlet protection from a round pipe flowing full, minimum tailwater condition ( $T_w < 0.5$  diameter).