PERMIT APPLICATION

Flowers LCID Recycling Center
Johnston County, North Carolina

Prepared for:

42 East, LLC
Clayton, North Carolina

July 2006

PERMIT ISSUE DOCUMENTS

G.N. Richardson & Associates, Inc.
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

G.N. RICHARDSON & ASSOCIATES
Engineering and Geological Services

July 10, 2006

Ms. Toni Wyche, E.I.
Environmental Engineer II
NC DENR - Division of Waste Management
401 Oberlin Road, Suite 150
Raleigh, NC 27605

Re: Processing Permit Application
Flowers LCID Recycling Center
Johnston County, North Carolina

Dear Ms. Wyche:

On behalf of 42 East, LLC, G.N. Richardson & Associates, Inc. (GNRA) would like to submit for your review the two (2) enclosed permit applications for the remedial development by processing of the former Flowers LCID Landfill located off of Motorcycle Road in Johnston County, North Carolina.

The application is complete (in accordance with the *Treatment and Processing Permit Guidelines*) except for emergency response information from the Johnston County Fire Marshall which is currently under review by them. Additionally, all stormwater permit applications have been filed with the Division of Land Quality and locally with the Johnston County Stormwater Administrator. All future correspondence and approvals will be copied to the Division. Should you have any questions or require clarification, please contact us at (919) 828-0577 ext. 127 or by email at stacey@gnra.com.

Sincerely,
G.N. Richardson & Associates, Inc.

Kinjal B. Shah, E.I.
Staff Engineer

Stacey A. Smith, P.E.
Project Manager

Att.
Cc: Gary Lynch, Shotwell Landfill, Inc.
Ben Barnes, NCDENR (LETTER ONLY)
File

D:\1Projects\Flowers LCID Landfill\Correspondence\letter7-10-06.wpd

PERMIT APPLICATION

Flowers LCID Recycling Center
Johnston County, North Carolina

Prepared for:

42 East, LLC
Clayton, North Carolina

July 2006

PERMIT ISSUE DOCUMENTS

G.N. Richardson & Associates, Inc.
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

PROCESSING PERMIT APPLICATION

Flowers LCID Recycling Center
Johnston County, North Carolina

Prepared for:
42 East, LLC
Clayton, North Carolina

To the Attention of:
Mr. Gary Lych
42 East, LLC

GNRA Project No. FLOWERS-06-1

7/7/2006
Kinjal B. Shah, Ed.
Staff Engineer

NORTH CAROLINA PROFESSIONAL SEAL 023002 ENGINEER STACEY A. SMITH

Stacey A. Smith, P.E.
Project Manager

July 2006

PERMIT ISSUE DOCUMENTS

G.N. Richardson & Associates, Inc.
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

42 EAST, LLC
FLOWERS LCID RECYCLING CENTER

PROCESSING PERMIT APPLICATION

TABLE OF CONTENTS

A guide to specific North Carolina Solid Waste Management (15A NCAC 13B.0300), Guidelines for Preparation of Permits Applications for MSW Treatment and Processing Facilities dated August 1, 1999 (T&P Guidelines) and Sedimentation Control (15A NCAC 4) rules addressed in each section of this document is shown in italics after each section.

EXECUTIVE SUMMARY

GENERAL

The following is a Processing Permit Application submitted on behalf of 42 East, LLC for construction and operation of a Land Clearing and Inert Debris (LCID) Processing Facility at the former Flowers LCID Landfill[1] (unpermitted) site in Johnston County, North Carolina. It is the intent of 42 East to proceed with the facility construction upon approval of this application.

This submittal focuses on the engineering design and operation of the processing facility. The attachments included herein comply with the submittal requirements stated in the Solid Waste Treatment and Processing Rules and *Guidelines for the Preparation of Permit Applications for MSW Treatment and Processing Facilities.*

The proposed use for the site includes remediation of an un-permitted LCID landfill owned by the late Mr. Billy Flowers[2]. The site is currently under a Notice of Violation by the North Carolina Department of Environment and Natural Resoures (NCDENR) Division of Waste Management[3]. Mr. Gary Lynch of 42 East, LLC recently purchased the property and has agreed to remediate through excavation and processing of the existing landfill under 15A NCAC 13B 0.300. The final development of the property will include returning the site to its original condition (prior to LCID placement).

The processing facility will include mining of the existing LCID landfill, sorting and grinding of the land clearing debris, and screening of the product to produce a combination of mulch, mulch and soil, and soil products for distribution to the public.

REGULATORY REFERENCES

This submittal has been prepared in accordance with the requirements of the North Carolina Treatment and Processing Rules (15A NCAC 13B.0300), *Guidance for Preparation of Permit Applications for Municipal Solid Waste Treatment and Processing Facilities*, Johnston County Stormwater Ordinances, and the North Carolina Sedimentation Control Rules (15A NCAC 4) which are enforced by the Division of Waste Management (DWM) and the Division of Land Quality, respectively, of the North Carolina Department of Environment and Natural Resources.

---

1 Land Clearing and Inert Debris Landfill Notification dated June 1993 recorded in Deed Book 1320, Page 451 at the Johnston County Register of Deeds.

2 Correspondence dated February 10, 2004 from Mr. Ben Barnes, NCDENR to Mr. Billy R. Flowers, Flowers LCID regarding Notice of Violation issued July 18, 2003.

3 Notice of Violation dated July 18, 2003 from Mr. Ben Barnes, NCDENR to Mr. Billy R. Flowers, Flowers LCID.

Included in this document are the following attachments *(with applicable rule(s) in italics)*:

Aerial Photograph & 1000 foot Radius Map *(T&P Guidelines);*
Zoning Documentation *(.0301 (2));*
Emergency & Fire Response Documentation *(T&P Guidelines);*
Cultural and Natural Heritage Documentation *(T&P Guidelines);*
Wetlands Documentation *(T&P Guidelines)*;
FEMA Map *(T&P Guidelines);*
Potentiometric Surface Map *(T&P Guidelines);*
Legal Description of the Property *(T&P Guidelines);*
Operations Manual *(.0302)*;
Erosion and Sedimentation Control Plan *(T&P Guidelines and 15A NCAC 4)*; and
Project Drawings *(.0301(1), and 15A NCAC 4))*.

The Operations Manual outlines and describes protocols for facility operation and maintenance and was prepared to provide Processing Facility personnel with a clear understanding of how the Design Engineer assumed that the completed facility would be operated. Along with the Project Drawings, the Operations Manual has been prepared to comply with the requirements of 15A NCAC 13B.0302. A copy of the Operations Manual is included in **Attachment F**.

The Erosion and Sedimentation Control Plan was prepared to describe both initial and long term (final) erosion and sedimentation control measures used at the site. This document, along with the Project Drawings, was prepared to satisfy the requirements of T&P Guidelines, Johnston County Stormwater Ordinances and 15A NCAC 4.

APPLICATION REQUIREMENTS

The following sections correspond with the permit application for a treatment and processing facility as outlined in the North Carolina Solid Waste Treatment and Processing Rules. The site plan drawing was prepared by a professional engineer duly registered in the State of North Carolina.

AERIAL PHOTOGRAPH

An aerial photograph (scale 1"= 200') is included with this permit application. This photograph depicts the entire property owned by 42 East, LLC (as proposed in this project) as well as all properties located within 1000 feet (radius) of the site. The entire 1000 foot radius surrounding the subject property is predominantly owned by 42 East, LLC except for two (2) subdivisions to the west (Magnolia and the Gardens at Flowers Plantation) and property owned by Ms. Rebecca D. Flowers to the north. The Aerial Photograph is included in **Attachment A**.

ZONING

A letter from Johnston County Planning & Zoning Department, the agency having zoning jurisdiction, has been obtained for the proposed project and has been included in **Attachment B**. The proposed remedial processing activities are allowed within the existing zoning.

SITING AND DESIGN STANDARDS

The following sections explain how the recycling facility complies with siting and design standards in Treatment and Processing Guidelines provided by the North Carolina Division of Waste Management and 15A NCAC 13B.0300.

Floodplain

The processing facility is not located within a floodplain. A copy of the FEMA Map for this area is included in **Attachment C.**

Cultural, Natural Heritage, and Endangered Species

The processing facility will not impact endangered or threatened species or impact any cultural or natural heritage resources. A copy of letters from Natural Heritage Program and the State Historic Preserve Office is included in **Attachment C.**

Ground Water Requirements

The facility is located on top of a closed landfill. The depth to seasonal high water table is significantly more than 12 inches from the proposed final remedial development. A Potentiometric Surface Map is included in **Attachment D**.

Surface Water Quality Standards

The facility is located near an unnamed tributary that discharges into Mill Creek. All runoff within the facility boundary is contained by two (2) permanent sediment basins and one (1) sediment trap. All site development will be conducted in accordance with the Neuse River Basin - Nutrient Sensitive Waters Managment Strategy (15A NCAC 2B .0235). The facility will only process Land Clearing and Inert Debris materials. The site does not include any wetlands within the development. A copy of a preliminary wetlands evaluation determination by Ralph Whitehead Associates, Inc. Is included in **Attachment C**.

Surface Water Buffer

The processing area is located greater than 100 feet from surface waters.

Property Line Buffer

A minimum of 50 foot buffer between the processing and storage areas and property lines is maintained. However, the existing of limits of waste extend to the property boundaries and in some cases beyond. As a part of the remedial operation, these limits of waste will be excavated and returned to their near original conditions (pre-LCID landfill).

Residence Buffer

A minimum 200 foot buffer between the processing areas and residences is maintained.

Well Buffer

There is one non-potable well located on the property and is within the existing limit of waste of the existing LCID landfill. However, a minimum 100 foot buffer between the processing areas is maintained from all other water supply wells.

Adequate Access

A 25 foot minimum distance will be maintained around the periphery of the processing area to allow adequate access by equipment and/or fire fighting equipment.

Public Access

The site will not allow uncontrolled public access. The entrance road to the site passes the guard house. The boundaries outside the processing area are currently undeveloped and are wooded with no other access roads.

Sedimentation Pollution Control Law

A Sedimentation and Erosion Control Plan is included in **Attachment G**. This plan outlines measures to be taken during facility construction to minimize any sediment run-off due to land disturbance.

PROPERTY DESCRIPTION

The proposed development impacts two (2) property tracts. Both properties are owned by 42 East, LLC. However, one (1) of the tracts is in the name of Mr. Gary Lynch, owner of 42 East, LLC. Legal descriptions for these properties are included in **Attachment E.**

EMERGENCY SERVICES

The proposed development is located in the Archer Lodge Fire District. A letter was obtained from the Fire Chief, confirming the jurisdiction and that this local department will be able to respond with appropriate equipment. A copy of the letter from the fire department is included in **Attachment B**.

All additional and detailed information required for a Permit to Construct is included in the following attachments:

Attachment A - Aerial Photograph & 1000 foot Radius Map
Attachment B - Zoning & Emergency Response Documentation
Attachment C - Cultural, Natural Heritage, and Wetlands Documentation
Attachment D - FEMA Map and Pontentiometric Surface Map
Attachment E - Legal Description of the Property
Attachment F - Operations Manual
Attachment G - Erosion and Sedimentation Control Manual
Attachment H - Project Drawings.

Johnston County

PLANNING & ZONING DEPARTMENT

"Here To Serve . . ."

March 16, 2006

REC'D MAR 17 2006

Gary K. Lynch
PO Box 1541
Clayton, NC 27520

Re: LCID Site off Motorcycle Road

Dear Mr. Lynch:

Per our conversation this morning, the Planning Department recognizes that a LCID site existed on your property identified with Tax ID #16K05001A. This operation appears to have begun in 1993 and verified by a letter from the Johnston County Planning Department dated the same.

Though this site has been inoperable for several years, the Johnston County Planning Department will allow for the clean up of any existing debris. Grinding, screening, recycling, and hauling off of the existing debris will be allowed. No County permits will be required to begin clean-up of your LCID as long as all State requirements are fulfilled. Should you have any questions, please contact the Johnston County Planning Department.

Sincerely,

Berry Gray

Berry Gray
Senior Planner

Cc: Stacey Smith, G.N. Richardson & Associates, Inc. ✓
Steven Finn, Johnston County Planning Department
Amanda Engesether, Johnston County Planning Department

309 East Market Street • Smithfield, NC 27577
Telephone (919) 989-5150 • (Fax) 919) 989-5426
www.johnstonnc.com

NCDENR

North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor

William G. Ross Jr., Secretary

April 10, 2006

Mr. Kinjal Shah
G.N. Richardson & Associates
14 N. Boylan Avenue
Raleigh, NC 27603

Subject: Proposed Wood Waste Recycling Facility; Clayton, Johnston County

Dear Mr. Shah:

The Natural Heritage Program has no record of rare species, significant natural communities, or significant natural heritage areas at the site nor within a mile of the project area. Although our maps do not show records of such natural heritage elements in the project area, it does not necessarily mean that they are not present. It may simply mean that the area has not been surveyed. The use of Natural Heritage Program data should not be substituted for actual field surveys, particularly if the project area contains suitable habitat for rare species, significant natural communities, or priority natural areas.

You may wish to check the Natural Heritage Program database website at www.ncnhp.org for a listing of rare plants and animals and significant natural communities in the county and on the topographic quad map. Alternatively, the NC Center for Geographic Information and Analysis (CGIA) provides digital Natural Heritage data online on a cost recovery basis. Subscribers can get site specific information on GIS layers with Natural Heritage Program rare species occurrences and Significant Natural Heritage Areas. The CGIA website provides Element Occurrence (EO) ID numbers (instead of species name), and the data user is then encouraged to contact the Natural Heritage Program for detailed information. This service allows the user to quickly and efficiently get site specific NHP data without visiting the NHP workroom or waiting for the Information Request to be answered by NHP staff. For more information about data formats, pricing structure and ordering procedures, visit http://www.cgia.state.nc.us/cgdb/datalist.html, or call CGIA Production Services at (919) 733-2090.

Please do not hesitate to contact me at 919-715-8697 if you have questions or need further information.

Sincerely,

Harry E. LeGrand, Jr.

Harry E. LeGrand, Jr., Zoologist
Natural Heritage Program

1601 Mail Service Center, Raleigh, North Carolina 27699-1601
Phone: 919-733-4984 • FAX: 919-715-3060 • Internet: www.enr.state.nc.us

North Carolina Department of Cultural Resources

State Historic Preservation Office

Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

April 11, 2006

Kinjal Shah
G.N. Richardson & Associates
14 N. Boylan Avenue
Raleigh, NC 27603

Re: Wood Waste Recycling Facility, Clayton, Johnston County, ER 06-0914

Dear Mr. Shah:

Thank you for your letter of March 28, 2006, concerning the above project.

We have conducted a review of the project and are aware of no historic resources that would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

RALPH WHITEHEAD ASSOCIATES, INC.
Consulting Engineers
Charlotte Atlanta Jacksonville Richmond
Rock Hill Charleston Kansas City Raleigh

Website:
www.rwhitehead.com

1000 W. Morehead Street
Suite 200
Charlotte, NC 28208

Mailing Address:
Post Office Box 35624
Charlotte, NC 28235

704 372-1885 Voice
704 372-3393 Fax

REC'D MAY 24 2006

Mr. Stacey Smith, Sr. Engineer
G.N. Richardson & Associates
14 North Boylan Avenue
Raleigh, North Carolina 27603

May 22, 2006

SUBJECT: Preliminary Wetlands Determination
Flowers' LCID Landfill
Johnston County, North Carolina

Dear Mr. Smith:

As authorized by 42 East LLC, Ralph Whitehead Associates, Inc. (RWA) performed a review of the subject site for the possible presence of wetlands and/or other jurisdictional waters of the U.S. The field review was performed on May 18, 2006. Our findings are summarized below.

Background

The subject site, known as the Flowers' LCID Landfill, is located north of NC 42 and south of Motorcycle Road in Johnston County, North Carolina (Figure 1). The site encompasses approximately 16 acres and is currently being used as a stump grinding and mulching area. Adjacent to the site is undeveloped mixed hardwood/pine upland forest. An unimproved access road, which connects to Motorcycle Road, is located at the northeast corner of the property. Based on Johnston County aerial photography and field review, the subject site consists of a large cleared and mulched area with two wet detention basins along the perimeter of the property. See Figure 1 for approximate size and location of the subject site.

Findings of Field Review

RWA Environmental Scientists W. Steven Busbee, PWS and Rhett Baggett conducted a review of the subject site on May 18, 2006. Potential wetland areas were determined using the U.S. Army Corps of Engineers (USACE) Routine On-Site Determination method as described in the 1987 "Corps of Engineers Wetlands Delineation Manual."[1] This technique uses a multi-parameter approach, which requires positive evidence of hydrophytic vegetation, wetland hydrology, and hydric soils.

No potential jurisdictional wetlands or other waters of the U.S. were identified within the Flowers' LCID Landfill site.

[1] Environmental Laboratory, 1987, "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Closing

We appreciate the opportunity to perform these services. Please do not hesitate to call either of the undersigned if you have any questions.

Sincerely,

RALPH WHITEHEAD ASSOCIATES, INC.

W. Steven Busbee

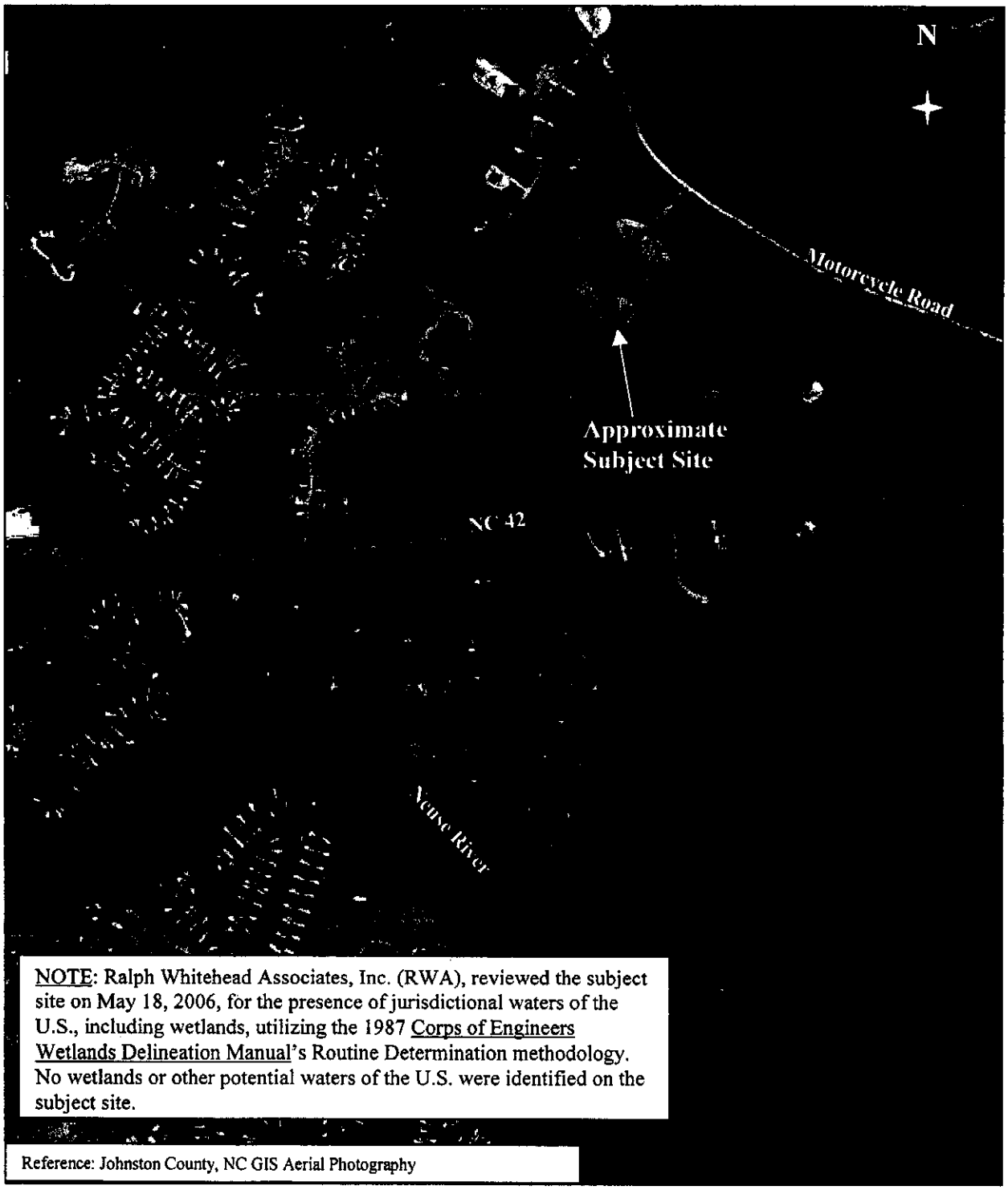
W. Steven Busbee, PWS
Project Environmental Scientist

Michael A. Tagnocco

Michael A. Tagnocco, PWS
Project Manager/Senior Scientist

Cc: Gary Lynch, 42 East, LLC

WSB/MAI.sb



NOTE: Ralph Whitehead Associates, Inc. (RWA), reviewed the subject site on May 18, 2006, for the presence of jurisdictional waters of the U.S., including wetlands, utilizing the 1987 Corps of Engineers Wetlands Delineation Manual's Routine Determination methodology. No wetlands or other potential waters of the U.S. were identified on the subject site.

Reference: Johnston County, NC GIS Aerial Photography

Flowers' LCID Landfill Site **Johnston County, NC**	**RALPH WHITEHEAD ASSOCIATES, INC.**	**Figure 1. Approximate Subject Site Location**

LCID LANDFILL PROPERTY

2800
0166

BOOK 2800 PAGE 166

Johnston County, North Carolina
CRAIG OLIVE Register of Deeds
The following certificate(s) of
LAWRENCE E KRISTOFF II

notary/notaries public
is/are certified to be correct.
Deputy - Assistant - Register of Deeds

FILED
JOHNSTON COUNTY
CRAIG OLIVE
REGISTER OF DEEDS

FILED	Nov 19, 2004
AT	04:05:00 pm
BOOK	02800
START PAGE	0166
END PAGE	0167
INSTRUMENT #	53205

Tracts, NC 42 and SR 1704, Wilders Tshp.
Prepared by and Hold for: Kristoff Law Offices, P.A.

Revenue Stamps: $0

NORTH CAROLINA
JOHNSTON COUNTY

Parcel ID No.: out of 16K05001Z

GENERAL WARRANTY DEED

THIS DEED made this 18th day of November, 2004, by and between BILLY R. FLOWERS, a single person, **Grantor;** and GARY K. LYNCH, **Grantee**, whose address is P.O. Box 1541, Clayton, North Carolina 27528 (the designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.);

WITNESSETH:

THAT the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does give, grant, bargain, and convey unto the Grantee, that certain lot or parcel of land situated in Wilders Township, Johnston County, North Carolina and more particularly described as follows:

BEGINNING at a new iron stake which is located South 34 degrees 11 minutes 54 seconds West 467.24 feet from the center line of N.C.S.R. 1704; thence, running South 25 degrees 26 minutes 16 seconds East 280.10 feet to a new iron stake; thence, running North 84 degrees 34 minutes 17 seconds East 90.80 feet to a new iron stake; thence, running South 56 degrees 40 minutes 28 seconds East 93.89 feet to a new iron stake; thence, running South 52 degrees 25 minutes 27 seconds East 175.90 feet to a new iron stake; thence, running South 32 degrees 20 minutes 40 seconds East 65.48 feet to a new iron stake; thence, running South 42 degrees 00 minutes 44 seconds East 103.05 feet to a new iron stake; thence, running South 63 degrees 33 minutes 22 seconds East 26.88 feet to a new iron stake; thence, running South 17 degrees 15 minutes 18 seconds East 100.80 feet to a new iron stake; thence, running South 39 degrees 20 minutes 28 seconds West 32.86 feet to a new iron stake; thence, running South 43 degrees 57 minutes 14 seconds East 74.59 feet to a new iron stake; South 20 degrees 25 minutes 56 seconds West 69.43 feet to a new iron stake; thence, running South 71 degrees 22 minutes 56 seconds West 50.65 feet to a new iron stake; thence, running North 89 degrees 24 minutes 20 seconds West 77.36 feet to a new iron stake; thence, running South 31 degrees 05 minutes 24 seconds West 71.02 feet to a new iron stake; thence, running South 81 degrees 21 minutes 52 seconds West 38.02 feet to a new iron stake; thence, running South 14 degrees 39 minutes 55 seconds West 74.33 feet to a new iron stake; thence, running South 12 degrees 26 minutes 37 seconds West 83.56 feet to a new iron stake; thence, running South 57 degrees 02 minutes 24 seconds West 190.47 feet to a new iron stake; thence, running North 82 degrees 24 minutes 50 seconds West 139.46 feet to a new iron stake; thence, running North 53 degrees 00 minutes 47 seconds West 110.21 feet to a new iron stake; thence, running South 79 degrees 11 minutes 11 seconds West 214.55 feet to a new iron stake; thence, running North 76 degrees 12 minutes 00 seconds West 87.51 feet to a new iron stake; thence, running North 47 degrees 58 minutes 45 seconds West 165.72 feet to a new iron stake; thence, running North 08 degrees 14 minutes 38 seconds West 74.46 feet to a new iron stake; thence, running North 37 degrees 25 minutes 04 seconds East 129.94 feet to a new iron stake; thence, running North 04 degrees 30 minutes 00 seconds West 192.58 feet to a new iron stake; thence, running North 34 degrees 11 minutes 40 seconds East 702.78 feet to the point and

place of BEGINNING and containing 16.205 acres, more or less.

For chain of title, see Deed Book 455, Page 381, Deed Book 1209, Page 169, Deed Book 1494, Page 497, Johnston County Registry.

SUBJECT, HOWEVER, to the following Exceptions:

1. Ad Valorem taxes for the year 2004 and thereafter;
2. Easements, Restrictions, Rights-of-Way, and other appurtenances of record in the Johnston County Registry.

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

AND THE GRANTOR covenants with the Grantee, that the Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions stated herein.

IN WITNESS WHEREOF, the Grantor has hereunto set their hands and seals, or if corporate, has caused this instrument to be signed in the corporate name by its duly authorized officers and its seal to be hereunto affixed by the authority of its Board of Directors, the day and year first above written.

_____ (SEAL)
BILLY R. FLOWERS

STATE OF NORTH CAROLINA
COUNTY OF JOHNSTON

LAWRENCE E. KRISTOFF, II NOTARY *** PUBLIC JOHNSTON COUNTY, NC

I, the undersigned notary public, in and for the County and State aforesaid, do hereby certify that Billy R. Flowers personally appeared before me this day and acknowledged the due execution of the foregoing instrument. Witness my hand and notarial stamp or seal on this the 15 day of November, 2004.

_____
NOTARY PUBLIC Lawrence E. Kristoff, II

My commission expires: 3/29/2005

SITE ENTRANCE PROPERTY

2800
0163

BOOK 2800 PAGE 163

Johnston County, North Carolina
CRAIG OLIVE Register of Deeds
The following certificate(s) of
LAWRENCE E KRISTOFF II

notary/notaries public
is/are certified to be correct.

Deputy - Assistant - Register of Deeds

FILED
JOHNSTON COUNTY
CRAIG OLIVE
REGISTER OF DEEDS

FILED	Nov 19, 2004
AT	04:05:00 pm
BOOK	02800
START PAGE	0163
END PAGE	0165
INSTRUMENT #	53204

Johnston County 11-19-2004
NORTH CAROLINA
Real Estate Excise Tax
$6,084.00

Tracts, NC 42 and SR 1704, Wilders Tshp.
Prepared by and Hold for: Kristoff Law Offices, P.A.

Revenue Stamps: $6,084.00

NORTH CAROLINA
JOHNSTON COUNTY

Parcel ID No.: 16K05001Z, 16K05001G
16J05002Q and 16J05002O

GENERAL WARRANTY DEED

THIS DEED made this 18th day of November, 2004, by and between BILLY R. FLOWERS (also known as Billy Rodrick Flowers), a single person, **Grantor;** and 42 EAST, LLC, a North Carolina Limited Liability Company, **Grantee**, whose address is 3308 Alleghany Drive, Raleigh, North Carolina 27609 (the designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.);

WITNESSETH:

THAT the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does give, grant, bargain, and convey unto the Grantee, that certain lot or parcel of land situated in Wilders Township, Johnston County, North Carolina and more particularly described as follows:

Tract #1: (ID# 16K0001Z)

BEING all of that tract of land containing 132.32 acres, more or less, as shown on that map recorded in Plat Book 63, Page 234, Johnston County Registry, to which plat reference is hereby made for a full and complete description of said tract of land.

LESS and EXCEPT the following tract of land:
BEGINNING at a new iron stake which is located South 34 degrees 11 minutes 54 seconds West 467.24 feet from the center line of N.C.S.R. 1704; thence, running South 25 degrees 26 minutes 16 seconds East 280.10 feet to a new iron stake; thence, running North 84 degrees 34 minutes 17 seconds East 90.80 feet to a new iron stake; thence, running South 56 degrees 40 minutes 28 seconds East 93.89 feet to a new iron stake; thence, running South 52 degrees 25 minutes 27 seconds East 175.90 feet to a new iron stake; thence, running South 32 degrees 20 minutes 40 seconds East 65.48 feet to a new iron stake; thence, running South 42 degrees 00 minutes 44 seconds East 103.05 feet to a new iron stake; thence, running South 63 degrees 33 minutes 22 seconds East 26.88 feet to a new iron stake; thence, running South 17 degrees 15 minutes 18 seconds East 100.80 feet to a new iron stake; thence, running South 39 degrees 20 minutes 28 seconds West 32.86 feet to a new iron stake; thence, running South 43 degrees 57 minutes 14 seconds East 74.59 feet to a new iron stake; South 20 degrees 25 minutes 56 seconds West 69.43 feet to a new iron stake; thence, running South 71 degrees 22 minutes 56 seconds West 50.65 feet to a new iron stake; thence, running North 89 degrees 24 minutes 20 seconds West 77.36 feet to a new iron stake; thence, running South 31 degrees 05 minutes 24 seconds West 71.02 feet to a new iron stake; thence, running South 81 degrees 21 minutes 52 seconds West 38.02 feet to a new iron stake; thence, running South 14 degrees 39 minutes 55 seconds West 74.33 feet to a new iron stake; thence, running South 12 degrees 26 minutes 37 seconds West 83.56 feet to a new iron stake; thence, running South 57 degrees 02 minutes 24 seconds West 190.47 feet to a new iron stake; thence, running North 82 degrees 24 minutes 50 seconds West 139.46 feet to a new iron stake; thence, running North 53 degrees 00 minutes

47 seconds West 110.21 feet to a new iron stake; thence, running South 79 degrees 11 minutes 11 seconds West 214.55 feet to a new iron stake; thence, running North 76 degrees 12 minutes 00 seconds West 87.51 feet to a new iron stake; thence, running North 47 degrees 58 minutes 45 seconds West 165.72 feet to a new iron stake; thence, running North 08 degrees 14 minutes 38 seconds West 74.46 feet to a new iron stake; thence, running North 37 degrees 25 minutes 04 seconds East 129.94 feet to a new iron stake; thence, running North 04 degrees 30 minutes 00 seconds West 192.58 feet to a new iron stake; thence, running North 34 degrees 11 minutes 40 seconds East 702.78 feet to the point and place of BEGINNING and containing 16.205 acres, more or less.

Tract #2: (ID# 16K05001G)

BEING all of Tract 1B, containing 33 acres, more or less, as shown on that map recorded in Plat Book 31, Page 297, Johnston County Registry, to which plat reference is hereby made for a full and complete description of said tract of land.

Tract #3: (ID# 16J05002Q)

BEING all of Tract 2, containing 2.80 acres, more or less, as shown on that map recorded in Plat Book 53, Page 262, Johnston County Registry, to which plat reference is hereby made for a full and complete description of said tract of land.

Tract #4: (ID# 16J05002O)

BEING all of Tract 3, containing 12.84 acres, more or less, as shown on that map recorded in Plat Book 57, Page 310, Johnston County Registry, to which plat reference is hereby made for a full and complete description of said tract of land.

For chain of title, see Deed Book 455, Page 381, Deed Book 1209, Page 169, Deed Book 1494, Page 497, Deed Book 485, Page 627, Deed Book 1780, Page 830, Deed Book 2699, Page 182, Deed Book 2794, Page 611, Johnston County Registry and 02 E 172, Johnston County Clerk of Superior Court.

SUBJECT, HOWEVER, to the following Exceptions:

1. Ad Valorem taxes for the year 2004 and thereafter;
2. Easements, Restrictions, Rights-of-Way, and other appurtenances of record in the Johnston County Registry.

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

AND THE GRANTOR covenants with the Grantee, that the Grantor is seized of the premises in fee simple, has the right to convey the same in fee simple, that title is marketable and free of all encumbrances, and that Grantor will warrant and defend the title against the lawful claims of all persons whomsoever except for the exceptions stated herein.

IN WITNESS WHEREOF, the Grantor has hereunto set their hands and seals, or if corporate, has caused this instrument to be signed in the corporate name by its duly authorized officers and its seal to be hereunto affixed by the authority of its Board of Directors, the day and year first above written.

Billy R. Flowers (SEAL)
BILLY R. FLOWERS

STATE OF NORTH CAROLINA
COUNTY OF JOHNSTON

I, the undersigned notary public, in and for the County and State aforesaid, do hereby certify that Billy R. Flowers personally appeared before me this day and acknowledged the due execution of the foregoing instrument. Witness my hand and notarial stamp or seal on this the 18th day of November, 2004.

NOTARY PUBLIC

LAWRENCE E. KRISTOFF II NOTARY PUBLIC JOHNSTON COUNTY, NC

My Commission expires: 3/29/2005

Operations Manual

Flowers LCID Recycling Center
Johnston County, North Carolina

Prepared for:
42 East, LLC
Clayton, North Carolina

July 2006

PERMIT ISSUE DOCUMENTS

G.N. Richardson & Associates, Inc.
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

42 EAST, LLC
FLOWERS LCID RECYCLING CENTER

OPERATIONS MANUAL

TABLE OF CONTENTS

Table of Contents (Continued) Page

SECTION 1.0
GENERAL FACILITY OPERATIONS

1.1 OVERVIEW

This Operations Manual was prepared for the Flowers LCID Recycling Center located off of Motorcycle Road near Flowers, North Carolina (see **Figure 1**). The proposed use for the site includes remediation of an un-permitted Land Clearing and Inert Debris (LCID) landfill owned by the late Mr. Billy Flowers[1]. The site is currently under a Notice of Violation by the North Carolina Department of Environment and Natural Resoures (NCDENR) Division of Waste Management[2]. The planned use of the site will provide for the remediation of the site through excavation and processing of the existing landfill under 15A NCAC 13B 0.300. The final development of the property will include returning the site to its original condition (prior to LCID placement).

The information contained herein was prepared to provide facility personnel with a clear understanding of how the Design Engineer assumed that the completed facility would be operated. While deviations from the operations outlined here may be acceptable, they should be reviewed and approved by the Design Engineer.

1.1.1 Processing Overview

The proposed processing at the site generally involves mining of the existing LCID, gross sorting of materials, grinding of land clearing debris materials, and screening of the material into three (3) products as follows:

- Mulch
- Mulch and Soil Combination (Amended Soil)
- Soil

Land clearing debris is defined as *solid waste which is generated solely from land clearing activities such as stumps, trees, limbs, brush, grass, and other naturally occurring vegetative matter.*

1.2 CONTACT INFORMATION

All correspondence and questions concerning the operation of the Flowers LCID Recycling Center should be directed to the appropriate contact personnel, Engineer, and State personnel listed below. For fire or police emergencies dial 911.

---

1 Correspondence dated February 10, 2004 from Mr. Ben Barnes, NCDENR to Mr. Billy R. Flowers, Flowers LCID regarding Notice of Violation issued July 18, 2003.

2 Notice of Violation dated July 18, 2003 from Mr. Ben Barnes, NCDENR to Mr. Billy R. Flowers, Flowers LCID.

1.2.1 Contact Person

42 East, LLC
Attn: Gary Lynch
P.O. Box 20012
Raleigh NC 27619
Phone: (919) 553-3187
Fax: (919) 553-9910
email: ccraftsmen@myway.com

1.2.2 Engineer

G. N. Richardson & Associates, Inc.
Attn: Stacey A. Smith, P.E.
14 N. Boylan Avenue
Raleigh NC 27603
Phone: (919) 828-0577
Fax: (919) 828-3899
email: stacey@gnra.com

1.2.3 North Carolina Department of Environment and Natural Resources

North Carolina Department of Environment and Natural Resources
401 Oberlin Road, Suite 150
Raleigh, NC 27605
Phone: (919) 508-8400
Fax: (919) 733-4810

Division of Waste Management (DWM) - Solid Waste Section:

Environmental Engineer II: Toni Wyche, E.I.
Branch Head: Ed Mussler, III, P.E.

Division of Land Resources - Land Quality Section:

Raleigh Office: 3800 Barrett Drive, P.O. Box 27687
Raleigh, NC 27611
Phone: (919) 571-4700

Regional Engineer: John Holley, P.E.

1.3 ACCESS CONTROL

Limiting access to the Flowers LCID Recycling Center is important for the following reasons:

- Unauthorized and illegal dumping of waste materials is prevented.
- Trespassing, and injury resulting therefrom, is discouraged.
- The risk of vandalism is greatly reduced.

The facility attendant will be on duty at all times when the facility is open for public use to enforce access restrictions.

1.3.1 Physical Restraints

The site will be accessed by Motorcycle Road. A guard house is provided at the entrance. Access to the recycling center includes an all-weather access road as well as a 25 foot clear buffer for access in the event of fire around the perimeter of the facility. The entrance off of Motorcycle Road will be securely locked during non-operating hours.

1.3.2 Security

Frequent inspections of gates and fences will be performed by facility personnel. Evidence of trespassing, vandalism, or illegal operation will be reported to the Owner.

1.4 SIGNAGE

A prominent sign containing the information required by the DWM will be placed just inside the main gate. This sign will provide information on facility name, operating hours and facility contact information. Service and maintenance roads for use by operations personnel will be clearly marked and barriers (e.g., traffic cones, barrels, etc.) will be provided as required.

1.5 COMMUNICATIONS

Due to the close proximity of the processing area and the guard house, communication will be maintained between the guard house and the processing areas verbally. The guard house will have a telephone (land or cell) in case of emergency and for the conduct of day-to-day business. Emergency telephone numbers are displayed in the guard house.

1.6 FIRE SAFETY

The possibility of fire at the recycling center must be anticipated in the daily operation of the facility. A combination of factory installed fire suppression systems and/or portable fire extinguishers will be operational on all heavy pieces of equipment at all times. For larger or more serious outbreaks, the local fire department will respond. A 25 foot clear perimeter will maintained around the processing area and between storage piles to allow access by fire department personnel. The facility is located in the Archer Lodge Fire District.

Potential fire hazards at the recycling center are created from the build-up of fine dry dust particles on and around operational motors and control panels. The presence of these build-ups can cause overheating and potential fire if periodic equipment cleaning and maintenance are not practiced. Portable fire extinguishers should be maintained in a state of readiness at the screen location and on each piece of moving equipment.

1.7 EQUIPMENT REQUIREMENTS

The facility will maintain on-site equipment required to perform the necessary mining, processing and screening activities. Periodic maintenance of all facility equipment, and minor and major repair work will be performed at designated maintenance zones on-site. Refer to equipment specific O&M Manuals for recommended equipment maintenance schedules.

1.8 PERSONNEL REQUIREMENTS

At least one (1) member of the supervisory staff will be trained in the processing equipment operations. Each facility employee will go through an annual training course (led by supervisory staff).

1.9 HEALTH AND SAFETY

All aspects of the recycling center operations were developed with the health and safety of the operating staff, customers, and neighbors in mind. Prior to commencement of operations of the facility, a member of the operating staff will be designated site safety officer. This individual, together with the facility's management will modify the site safety and emergency response program to remain consistent with National Solid Waste Management Association and Occupational Safety and Health Administration (OSHA) guidance.

Safety equipment provided includes equipment rollover protective cabs, seat belts, audible reverse warning devices, hard hats, safety shoes, and first aid kits. Facility personnel will be encouraged to complete the American Red Cross Basic First Aid Course. Other safety requirements as designated by the Owner will also be implemented.

Each facility employee will go through annual training course in health and safety (led by supervisory staff). All training shall be documented and attested to by signatures of the trainer and trainee. The following are some general recommendations for the health and safety of workers at the Flowers LCID Recycling Center.

1.9.1 Personal Hygiene

The following items are recommended as a minimum of practice:

- Wash hands before eating, drinking, or smoking.
- Wear personal protective equipment as described in **Section 1.9.2.**
- Wash, disinfect, and bandage ANY cut, no matter how small it is. Any break in the skin can become a source of infection.
- Keep fingernails closely trimmed and clean (dirty nails can harbor pathogens).

1.9.2 Personal Protective Equipment

Personal Protective Equipment (PPE) must be evaluated as to the level of protection necessary for particular operating conditions and then made available to facility employees. The list below includes the PPE typically used and/or required in a compost facility workplace.

- Safety shoes with steel toes.
- Noise reduction protection should be used in areas where extended exposure to continuous high decibel levels are expected.
- Disposable rubber latex or chemical resistant gloves for handling and/or sampling of waste materials.
- Dust filter masks

Following use, PPE's should be disposed of or adequately cleaned, dried, or readied for reuse.

1.9.3 Mechanical Equipment Hazard Prevention

The loaders and other equipment should be operated with care and caution. All safety equipment such as horns, backup alarms, and lights should be functional. A Lockout-Tagout program shall be used to identify equipment in need or under repair and insure that operation is "off-limits" prior to maintenance or repair. All operators shall be trained in the proper operation of equipment.

1.9.4 Employee Health and Safety

Some general safety rules are:

- Consider safety first when planning and conducting activities.
- Review the equipment O&M Manual prior to attempting repairs/changes.
- Remember the buddy system in case of repair of mechanical equipment
- Post emergency contact phone numbers.
- Provide easy and visible access to the Right to Know materials.
- Provide easy and visible access to the first aid kit and fire extinguishers.

1.9.5 Physical Exposure

Facility personnel may come in contact with the fluids, solids, and airborne constituents found at recycling center. Routine training should be conducted regarding the individual and collective materials used in the recycling process and their associated hazards. Training concerning safe work practices around these potential exposures should use equipment and proper disposal procedures.

1.9.6 Material Safety Data Sheets

Material Safety Data Sheets (MSDS) shall be collected on every waste (if available) that enters the facility. Information shall also be made available for all chemicals stored on site for use by the County. MSDS sheets shall be stored in a location with all other Right to Know information for the site.

1.10 UTILITIES

Electrical power, water, telephone, and portable restrooms will be provided at the guard house.

1.11 RECORD KEEPING PROGRAM

The facility shall maintain the following documents in an operating record at the facility in accordance with **Section 4.0** of this document. The operating record will be kept up to date by the Site Manager or his designee. It will be presented upon request to DWM for inspection. A copy of this Operations Manual will be kept at the facility and will be available for use at all times.

SECTION 2.0
PROCESSING OPERATIONS

2.1 OVERVIEW

This section describes the processing operations for the Flowers LCID Recycling Center.

2.2 ACCEPTABLE WASTES

The proposed recycling center will only accept and process organic materials considered inert in nature. The materials acceptable for processing on the site include (at a minimum) reclaimed (mined) materials from the existing LCID landfill as follows:

- Land clearing waste such as stumps, trees, limbs, brush, grass, and other naturally occurring vegetative materials;
- Site clearing debris;
- High carbon nitrogen (C:N) yard waste such as brush, tree limbs, and similar vegetative matter with C:N ratios greater than 75;
- Untreated and unpainted wood wastes that have not been glued, treated with preservatives, painted, stained, or varnished;
- Agricultural processing wastes such as tobacco dust or cotton gin trash; and
- Other wastes as approved by the Division of Waste Management.

The recycling center will not accept waste from the public. All waste will be excavated from the existing LCID landfill. As the site is reclaimed, only materials listed above will be processed. All other identified wastes will be removed and disposed in accordance with **Section 2.3**.

2.3 WASTE ACCEPTANCE

Since the project is a remedial measure, no waste will be accepted at the site from the public for processing. All material for processing will be from the reclamation mining of the site. The Flowers LCID Recycling Center estimates it will mine for processing (on average) about 250 cubic yards per day (~260 days per year) of wastes for composting. The operating hours of the facility are anticipated to be from 7:00 a.m. to 6:00 p.m. Monday through Saturday. Thus, approximately 65,000 cubic yards per year (maximum) of wastes are anticipated for composting at the proposed facility. It is estimated that the site includes approximately 130,000 to 140,000 cubic yards[1] of waste and soil for processing to completely reclaim the site. The anticipated reclamation schedule is then estimated to be on the order of two (2) to three (3) years. Calculations projecting these volumes are provided in **Appendix A**.

---

[1] This volume estimate is based on a comparison of the pre-developed USGS topography of the site with current conditions. Assuming all additional material was hauled in for disposal.

2.4 WASTE SCREENING

In order to assure that prohibited wastes are not processed, waste screening programs will be implemented. During reclamation of the landfill, a spotter will be used to monitor the mining activities and identify any non-acceptable wastes. If any non-acceptable wastes are identified, these wastes will be placed into a stockpile or container and removed from the site for disposal at a solid waste facility permitted to accept the particular waste. All records and receipts for this disposal shall be kept in the operating record for the site. It is anticipated that unacceptable wastes will either be generally classified as construction and demolition debris (C&D), white goods, or recyclable materials (i.e. plastic, steel, etc.) based on earlier correspondence regarding historical violations[2] at the site. The individual spotters and operators will be trained on identifying non-conforming/non-acceptable wastes.

2.5 PROCESSING OPERATIONS

The recycling process involves a flow through of excavated material from the existing LCID landfill. Generally, the process includes excavation, sorting of the material into small and large fraction materials for grinding and screening. The utlimate product would include mulch products and soil products. This section provides discussion on the major components of the process. Please refer to **Figure 2** for a flowchart outlining the overall process.

2.5.1 Operating Capacity

The Operating Capacity for the Flowers LCID Recycling Center is estimated to be approximately 250 cubic yards of material undergoing processing per day.

2.5.2 Equipment Requirements

The anticipated equipment requirements for operation and maintenance of the site are listed in the following table.

Description	Primary Function (Allocation)
1) Excavator	LCID landfill mining and sorting
2) Front End Loader	loading and mixing
3) Grinder (Bandit Beast)	grinding/shredding of bulky wastes, stumps, limbs, etc.
4) Screening Equipment (Extec)	processing material to uniform consistency and sorting of various gradations.
5) Dump Truck	hauling material around site.

[2] Compliance Order with Administrative Penalty dated March 25, 1996 to Mr. Billy Flowers from Mr. William L. Meyer, Division of Solid Waste Management.

2.5.3 Grinding/Chipping

Grinding and/or chipping will be conducted centrally on the site. The grinding/chipping operations will be conducted as needed to facilitate the recycling operations by using Bandit Beast Recycler Model 3680[3] or equivalent unit (specifications provided in **Appendix B**). The facility intends to utilize a single grinder to process the collected material. The material excavated from the LCID landfill will be directed to the grinders as per the material size. It is anticipated that grinding and chipping will be conducted on a continual basis. Grinders and chippers pose both maintenance and safety hazards. Therefore, please refer to the manufacturer's safety and or maintenance literature prior to operating equipment at the site.

2.5.4 Screening

Screening will be conducted just beyond the grinding area centrally on the site. An Extec Model E7[4] or equivalent screening machine will be used for this operation (specifications provided in **Appendix B**). The facility intends to utilize a single screening machine to process the ground materials. Screening is conducted after the grinding/chipping has been completed to provide a uniform material for distribution to the public. The screening process removes remaining large materials for a uniform product. The material is screened to achieve particle sizes of 5/8" to 2". The material not passing the screen, "overs" (>2"), are stored in the material storage area and re-ground or chipped for additional screening. The finished product is stored on site in a loading area until ready for delivery. Three (3) finished products are anticipated as follows:

- Mulch;
- Amended Mulch and Soil; and
- Soil/Topsoil.

The process is repeated for "overs" until a uniform blend is achieved. During the screening process additional non-conforming wastes may be identified. Once identified, these wastes will be removed and placed in the stockpiles or containers for disposal off-site. Screening machines pose both maintenance and safety hazards. Therefore, please refer to the manufacturer's safety and or maintenance literature prior to operating equipment at the site.

2.5.5 Access and Roadways

The site has been designed to provide all-weather access to the processing area.

---

[3] Additional information can be found at www.banditchippers.com

[4] Additional information can be found at www.extecscreens.com

2.6 FINAL PRODUCT

Once the processing is completed to meet the specifications of this plan, on-site storage will be necessary until the product can be delivered. The area designated for the finished products will be accessible for both equipment involved in the storage as well as the equipment involved in loading the finished product off-site. The storage areas provide a buffer between processing operations and truck loading operations to maintain a safe controlled working environment.

Areas designated for storage will be protected against excessive runoff, soil loss or erosion by providing surface water diversions, silt fence, applying mulch products, or other best management practices (BMP's). The stockpiles shall not exceed heights beyond the limits of equipment available on-site or in such quantities as to provide a fire hazard due to decomposition (i.e. for the mulch product).

2.7 TROUBLESHOOTING

The final product must be maintained and monitored to prevent fire potential and to maintain an acceptable product. Typical problems and solutions have been provided in **Table 2.2.** This table may be updated from time to time to include additional information about the specific process at this site.

TABLE 2.2 TROUBLESHOOTING

Condition	Reason	Check	Remedy
PILE TEMPERATURE TOO HIGH (>150 °F)	INSUFFICIENT AERATION	IS PILE MOIST?	TURN PILE OR AERATE
	PILE IS TOO LARGE	HEIGHT > 8 FEET?	DECREASE PILE HEIGHT
EXTREMELY HIGH TEMPERATURE (>170 °F)	SPONTANEOUS COMBUSTION	LOW MOISTURE? BURNT SMELL?	DECREASE PILE SIZE, ADD WATER TO SMOLDERING SECTION, AND COMBINE WITH OTHER PILES
ODORS IN PILE	PILES ARE TOO LARGE	HEIGHT > 8 FEET OR WIDTH > 20 FEET ?	DECREASE PILE SIZE
NON-UNIFORM TEXTURE	POOR MIXING	ORIGINAL RAW MATERIALS DISCERNIBLE?	SCREEN PRODUCT & IMPROVE MIXING

2.8 MARKETS

The market for the proposed mulch and soil product will include the surrounding residential and commercial development in the area. The primary customers are assumed to be landscaping and grading companies through the remedial development period. All final product material will be delivered to the customer by Flowers LCID Recycling Center representatives.

SECTION 3.0
ENVIRONMENTAL MANAGEMENT

3.1 OVERVIEW

This section reviews the overall environmental management tasks required for the successful operation of the Flowers LCID Recycling Center. Emphasis is given to the supplemental tasks required for the new facility. The definition of "surface water" as used herein is water which results from precipitation or site run-on that has not contacted the waste.

3.2 SURFACE WATER CONTROL

Proper control of surface water at the recycling center will accomplish the following goals:

- Limit the erosion caused by surface waters, and
- Limit sediments carried off-site by surface waters.

A separate erosion and sedimentation control plan is provided as **Attachment G** to the Processing Permit Application. This plan describes both short and long term engineered features and practices for preventing erosion and controlling sedimentation at this site in accordance with 15A NCAC 4, Sediment Pollution Control Laws. The following is a brief discussion of some of these features and practices.

3.2.1 Erosion Control

Erosion control provisions incorporated in and around the processing area include the following:

- Drainage swales are provided to gather surface water from entire site.
- Water collected by each drainage swale is routed to the sediment basins or traps.
- As areas reach final grade and that are not included in the processing areas must be seeded immediately.

All areas should be inspected regularly for erosion damage and promptly repaired.

3.2.2 Sedimentation Control

Stormwater run-off from the recycling facility is conveyed to the proposed sediment basins and traps. The basins should be inspected regularly for sediment build-up or erosion damage and should be cleaned out when sediments fill the lower half of the basin.

3.3 DUST CONTROL

Dust related to equipment operations and traffic on the access roads will be minimized by using a water truck to limit dust on the gravel portion of the road. Fugitive dust emissions are anticipated during grinding and screening operations and should not be conducted when wind speeds exceed 10 miles per hour. Additionally, screening should not be conducted on materials with less than 35% moisture content to minimize the effect of dust on the surrounding area.

3.4 SEVERE WEATHER CONDITIONS

Unusual weather conditions can directly affect the operation of the processing. Some of these weather conditions and recommended operational responses are as follows.

3.4.1 Ice Storms

An ice storm can make access to the site dangerous, prevent movement or placement of materials, and, thus, may require closure of the recycling center until the ice is removed or has melted.

3.4.2 Heavy Rains

Exposed stock piles of unprocessed materials can be eroded during rainy periods. Also storage of the final product can be eroded during rainy periods. The eroded material in the processing areas will be transported to the sediment basins. After such a rain event, inspection by facility personnel will be initiated and corrective measures taken to repair any damage found before the next rainfall.

3.4.3 Electrical Storms

In electrical storms, if necessary, grinding, screening, or production distribution activities will be temporarily suspended during such an event. To guarantee the safety of all field personnel, refuge will be taken in the on-site guard house or in rubber-tired vehicles.

3.4.4 Windy Conditions

Windy conditions may increase the risk of blown debris or an increase in dust. As applicable, dusty areas will be watered to minimize exposure.

3.4.5 Violent Storms

In the event of hurricane, tornado, or severe winter storm warning issued by the National Weather Service, facility operations may be temporarily suspended until the warning is lifted. All final products outside the processing area may be covered and secured with tarps to prevent excessive erosion of the pile.

SECTION 4.0
QUALITY ASSURANCE AND REPORTING

4.1 OVERVIEW

This section reviews the overall quality assurance and reporting tasks required for the distribution of the finished product. The information contained herein was prepared to provide facility personnel with methodology and reporting requirements to satisfy these requirements.

4.2 DOCUMENTATION

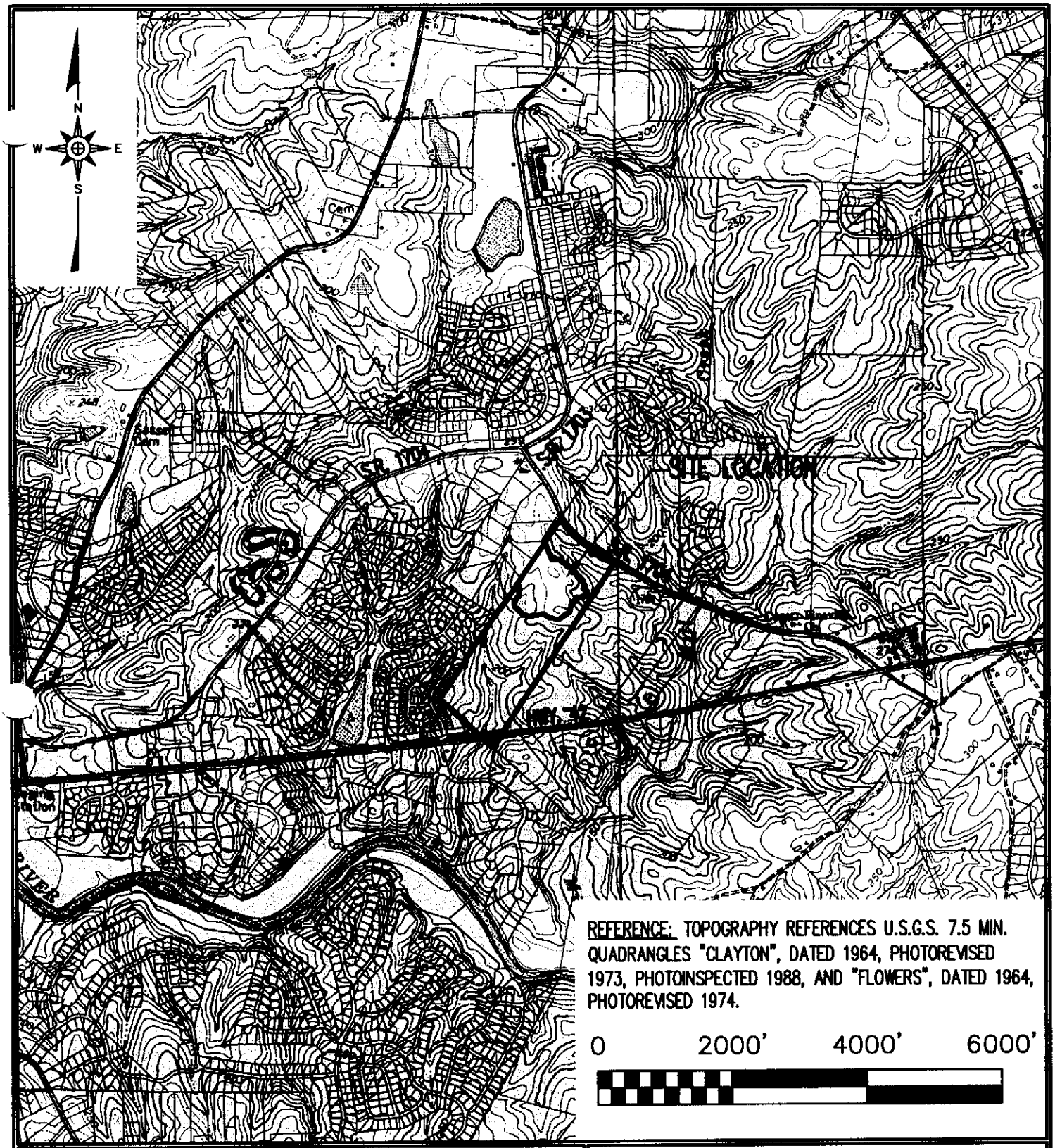
An essential component of the process is documentation from the time the materials enter the process to the last cubic yard of material that is delivered to the customer. The documentation is used to improve efficiency in the process, modify process designs, and in troubleshooting of the process. The establishment of a reliable continuing record for proof of performance, thus justifies operational decisions, expenditures, and recommendations. Daily operational records also provide information useful in process adjustments required due to climatic or seasonal changes or other recurring problems of a specific nature. Accurate records also provide the basis for planning future expansion, planning future modifications, establishing and adjusting operating budgets, and providing evidence of performance in compliance with regulatory agencies.

The NC DENR Division of Waste Management requires record keeping on the inflow and outflow of material. Personnel from the NC DENR Division of Waste Management will make periodic visits to the facility. During these inspections, a review of operational and other records may be requested.

The following are points in the process where monitoring documentation are anticipated:

a. Waste Screening Logs
b. Un-Acceptable Wastes Disposal Tickets
c. Grinding and Chipping Logs
d. Laboratory Testing identifying soil or mulch properties such as density and gradation (if performed).
e. Screening Logs
f. Finished Product Inventory identifying the quantity and type of material produced by classification.
g. Annual Report for the period of July 1 to June 30 shall be submitted to the Division by August 1st of each year.

Figures



REFERENCE: TOPOGRAPHY REFERENCES U.S.G.S. 7.5 MIN. QUADRANGLES "CLAYTON", DATED 1964, PHOTOREVISED 1973, PHOTOINSPECTED 1988, AND "FLOWERS", DATED 1964, PHOTOREVISED 1974.

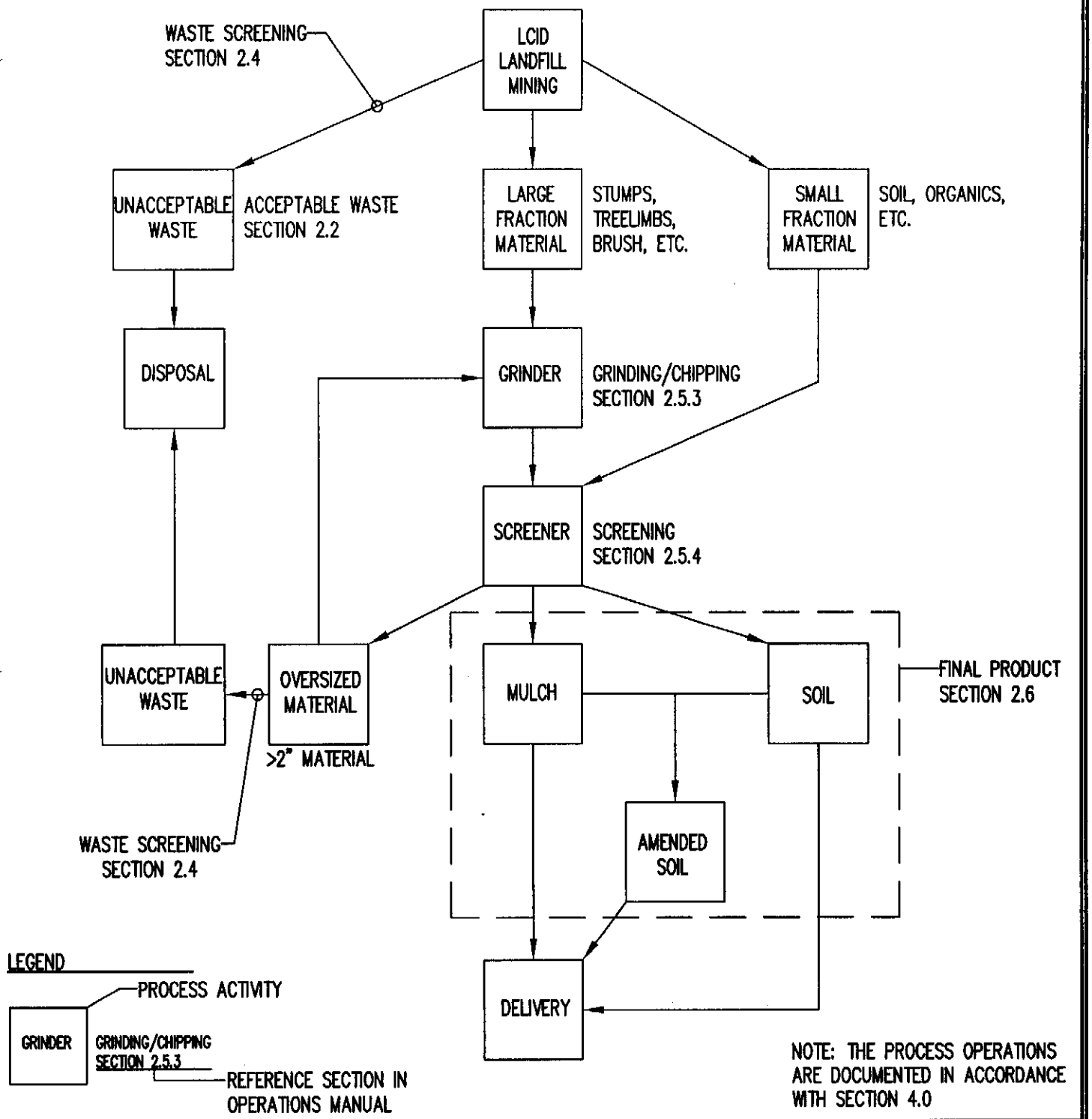
0 2000' 4000' 6000'

SITE LOCATION MAP

G. N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.gnra.com
ph: 919-828-0577
fax: 919-828-3899

SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
AS SHOWN	C.T.J.		Jun. 2006	FLOWERS 06-1	1	FLOWERS-A0013

G:\CAD\42 East LLC\Flowers 06-1\sheets\FLOWERS-A0013.dwg, 7/6/2006 3:59:16 PM



FLOWERS LCID RECYCLING CENTER PROCESSING OPERATIONS

G. N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.gnra.com
ph: 919-828-0577
fax: 919-828-3899

SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
NOT TO SCALE	J.A.M.	S.A.S.	Jun. 2006	FLOWERS-06-1	2	FLOWERS-A0020

G:\CAD\42 East LLC\Flowers 06-1\sheets\FLOWERS-A0020.dwg, 6/29/2006 11:48:45 AM

Appendix A

Process Area Calculations

PROJECT Flowers LCID Recycling Center
SUBJECT Design - Flower's Recycling unit

SHEET 1 OF
JOB NO. Flowers 06-1
DATE 5/23/2006
COMPUTED BY KBS
CHECKED BY

Objective : Design the area required for the following components of Flowers' LCID Recycling facility.

① Grinder / chipper
② screener
③ storage area.

Reference : → Bandit Industries, Inc.; "Beast Recyclers (models 2680, 3680, 4680 & 5680)"
→ Extec, "E-7 screener"
→ USGS topo compared with April 2, 2006 survey date.

[1] Grinder / chipper :

The 3680 Beast Recycler was considered for flower's LCID Recyding facility.

Specifications: (Ref : 1)

Height = 13' 3"
Width = 9' 7"
Length = 39'
Discharge conveyor = 48" wide x 30' long.
Feed rate = 18-43 FPM
unit operation = 350 $\frac{cy}{hr}$ or 100 ton/hr.
Discharge height = 17.5'

G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
425 N. Boylan Avenue Raleigh, North Carolina
(919)-828-0577 Fax:(919)-828-3899 www.gnra.com

PROJECT Flower's LCID Recycling Center
SUBJECT Design – Flower's Recycling unit

SHEET 2 OF 7
JOB NO. Flower 06-1
DATE 5/23/2006
COMPUTED BY KBS
CHECKED BY

Calculations :

2 → (a) Find Require number of units

* Waste on the property = 130,000 CY (from Recent survey Ref : 3)

Grinder capacity = 350 CY/hr.

∴ Total operational hrs Req'd = $\frac{130,000 \text{ CY}}{350 \text{ CY/hr}}$

= 372 hrs

* Assume excavate area = 250 CY / day to run the facity for atleast couple of years.

∴ operational hrs Required = $\frac{250 \text{ CY/day}}{350 \text{ CY/hr}}$

≅ 1 hr/day

Only one unit would be enough to serve the LCID Recycling facitty

∴ Total no. of operational hrs based on this assumpsion = $\frac{130,000 \text{ CY}}{250 \text{ CY/hr}}$ = 520 hrs ≅ 2 years

G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
425 N. Boylan Avenue Raleigh, North Carolina
(919)-828-0577 Fax:(919)-828-3899 www.gnra.com

(b) Incoming material handled by grinder :–

If ⑤ 1 HR/DAY to handle the excavated material, then facility could receive maximum,

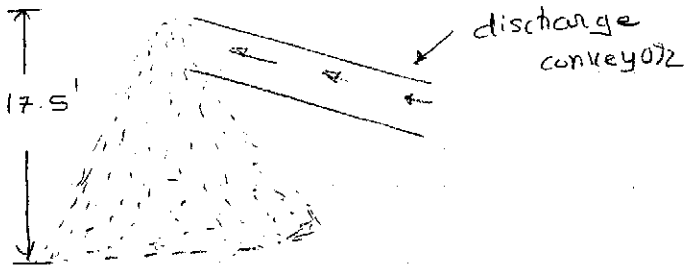
$$\frac{350 \ \frac{CY}{hr} \times 7 \ hrs}{day} = 2450 \ CY/day$$ of outside material

(Note : Here 8 hrs / day is considered as a working period. Grinder takes 1 hr to excavate & sort the facility material & 7 hrs to operate outside facility material)

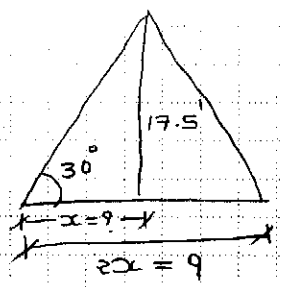
G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
425 N. Boylan Avenue Raleigh, North Carolina
(919)-828-0577 Fax:(919)-828-3899 www.gnra.com

(b) Find stock pile area :

The material discharges at the height of 17.5' from 48" wide x 30' long discharge conveyor.



Assume material discharges from conveyor makes an angle 30° with the ground.
(Here, 30° is assumed as conservatively)



To find 'x',

$$\tan 30^\circ = \frac{17.5'}{x}$$

$$\Rightarrow x = \frac{17.5'}{0.577}$$

$$= 30.31'$$

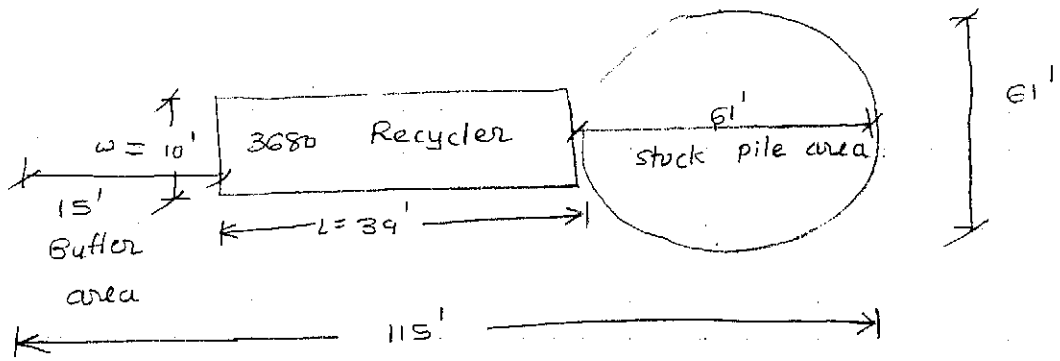
$$\Rightarrow 2x = 60.62'$$

G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
425 N. Boylan Avenue Raleigh, North Carolina
(919)-828-0577 Fax:(919)-828-3899 www.gnra.com

PROJECT Flower's LCID Recycling Center
SUBJECT Design - Flower's Recycling Unit

SHEET 5 OF 7
JOB NO. Flowers 06-1
DATE 5/23/2006
COMPUTED BY KBS
CHECKED BY SM

[C] Design the area for Grinder :-



PLAN VIEW

Area needed = $61' \times 115'$

Area designed = $70' \times 130'$ ∴ OK

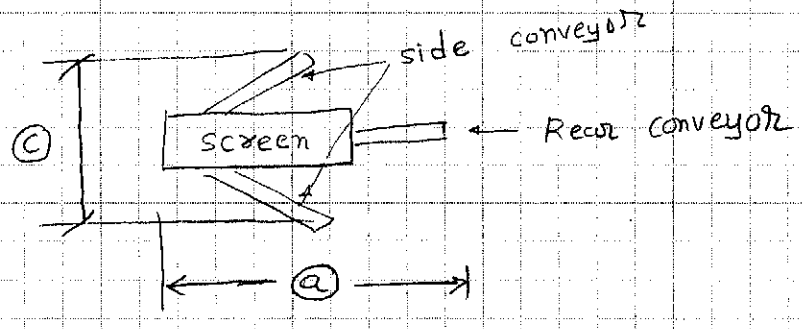
G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
425 N. Boylan Avenue Raleigh, North Carolina
(919)-828-0577 Fax:(919)-828-3899 www.gnra.com

2 Screener : (Reference - 2)

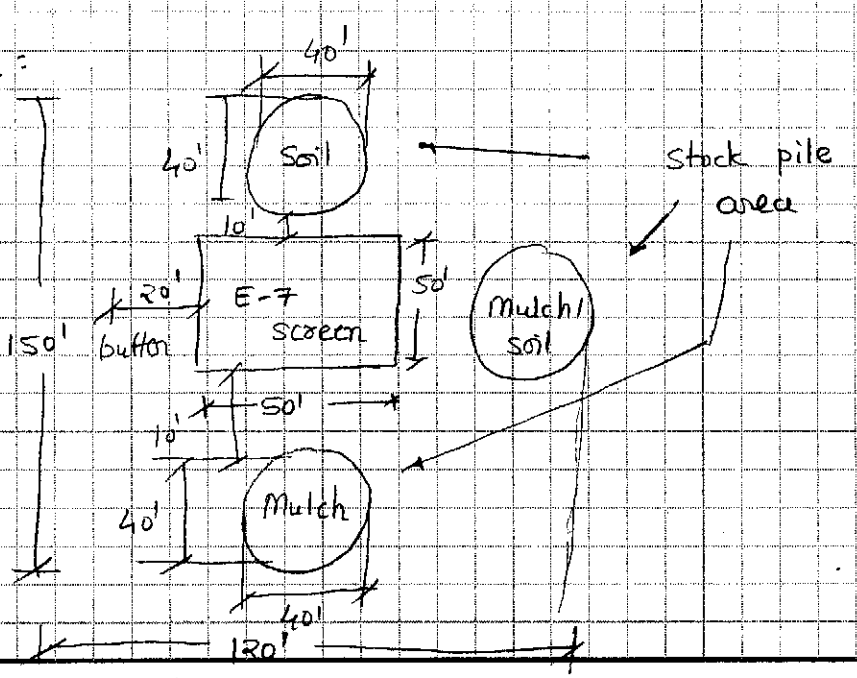
Extec E-7 screen was considered for flower's LCID Recycling facility.

* Specifications :

Machine Length = 47' 3" — (a)
Machine Height = 13' 11" — (b)
Machine width = 43' 1" — (c)



* Design :



G. N. RICHARDSON & ASSOCIATES
Engineering & Geological Services
14 N. Boylan Avenue, Raleigh, NC 27603
Telephone (919) 828-0577

PROJECT Flower's LCID Recycling Center
SUBJECT Design – Flower's Recycling Unit

SHEET 7 OF 7
JOB NO. Flowers 06-1
DATE 5/23/2006
COMPUTED BY KBS
CHECKED BY

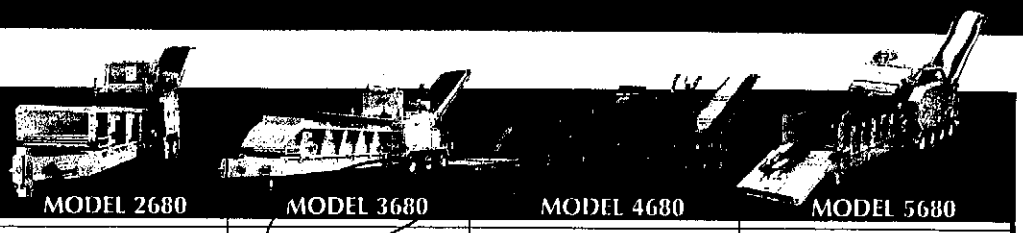
(3) Storage Area:

storage area was assumed 50' x 110' for each storage of soil, soil/mulch & mulch.

G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
425 N. Boylan Avenue Raleigh, North Carolina
(919)-828-0577 Fax:(919)-828-3899 www.gnra.com

Appendix B

Process Equipment Specifications



SPECIFICATIONS	MODEL 2680	MODEL 3680	MODEL 4680	MODEL 5680
Dimensions				
Height:	13' 3"	13' 3"	13' 6"	13' 6"
Width:	8' 6"	9' 2"	11' 6"	11' 6"
Length:	32' 3"	39'	46'	48' 9"
Weight:	39,000 lbs.	57,500 lbs.	84,000 lbs.	95,000 lbs.
Mill Opening:	24" high x 60" wide	33" high x 60" wide	45" high x 60" wide	50" high x 80" wide
Towing Hitch:	Pintle	Pintle	Fifth Wheel	Fifth Wheel
Optional Hitch:	Fifth Wheel	Fifth Wheel	N/A	N/A
Tires and Axles:				
Suspension:	Dual 15,000 # axle	Tri 25,000 # axles	Dual wheel/tri 25,000 # axles	Dual wheel/quad 25,000 # axle
Tires:	(4) 315/80R 22, 5 ply	(6) 385/65R 22.5, 5 ply	(12) 255/70R, 16 ply	(16) 255/70R 22.5, 16 ply
Front Stabilizer:	Single	Single	Single	Single
Steel Fuel Tank Capacity:	200 gallon	500 gallon	500 gallon	600 gallon
Steel Hydraulic Tank Capacity:	140 gallon	140 gallon	200 gallon	200 gallon
Infeed Conveyor:	HD track-type 5' wide x 13' 6" long	HD track-type 5' wide x 20' long 3 speed drive	HD track-type 60" wide x 19' 6" long 3 speed drive	HD Track-type 80" wide x 19' 6" long 3 speed drive
Feed System:	24" diameter x 60" long feed wheel with hydraulic gear reduction drive	24" diameter x 60" long feed wheel with hydraulic gear reduction drive	32" diameter x 60" long feed wheel with hydraulic gear reduction drive	36" diameter x 80" long feed wheel with hydraulic gear reduction drive
Cutting Diameter:	42" diameter x 63" wide, 60 cutting teeth	42" diameter x 63" wide 60 cutting teeth	59 1/2" diameter x 63" wide 60 cutting teeth 30 cutting teeth (optional)	65 1/2" diameter x 83" wide 80 cutting teeth 40 cutting teeth (optional)
Screens:	(1) 25" x 63" screen in drop gate is 10" wide	(1) 25" x 63" screen in drop gate is 10" wide	(2) 25" x 63" (1) 17" x 63" screen in drop gate is 17" wide	(2) 27" x 83" (1) 16 1/2" x 83" screen in drop gate is 17" wide
Anvil:	Continuous conveyor chain plus secondary anvil	Continuous conveyor chain plus secondary anvil	Continuous conveyor chain plus secondary anvil	Continuous conveyor chain plus secondary anvil
Operating Controls:				
Auto Feed Plus:	Standard	Standard	Standard	Standard
Dust Suppression System:	Standard	Standard	Standard	Standard
Tether remote:	Standard	Standard	Standard	Standard
Radio remote:	Optional	Standard	Standard	Standard
Standard Colors:	Bandit yellow, white, green, construction yellow, orange	Bandit yellow, white, green, construction yellow, orange	Bandit yellow, white, green, construction yellow, orange	Bandit yellow, white, green, construction yellow, orange
Discharge Conveyor:				
Primary Belt Conveyor:	48" wide x 18' long, v-cleat	48" wide x 30' long, v-cleat	56" wide x 10' long	72" wide x 27' long
Secondary Belt Conveyor	None	None	48" wide, x 27' long, v-cleat	48" wide x 58' long, v-cleat
Optional belt conveyor:	30' long	None	None	None
Diesel Power Options:	Caterpillar 300 & 395 HP Cummins 330 & 400 HP	Caterpillar 395,565 & 645 HP Cummins 525 HP and 700 HP	Caterpillar 760, 860 and 999 HP Cummins 860, 960 and 1000 HP	Caterpillar 860 and 999 HP Cummins 860, 960 and 1000 HP
Electric power options:	A variety of electric power options are offered on all units. Call for a quote.			
Customize With:				
42" thrower option	Optional	Optional	N/A	N/A
Magnetic head pulley	Optional	Standard	Standard	Standard
Reversing fan	Optional	Optional	Standard	Standard
Fluid clutch	Optional	Optional	Optional	Optional

SPECIFICATION AND DESIGN SUBJECT TO CHANGE WITHOUT NOTICE. DIMENSIONS AND WEIGHT VARY DEPENDING ON OPTIONS AND ENGINES SELECTED.

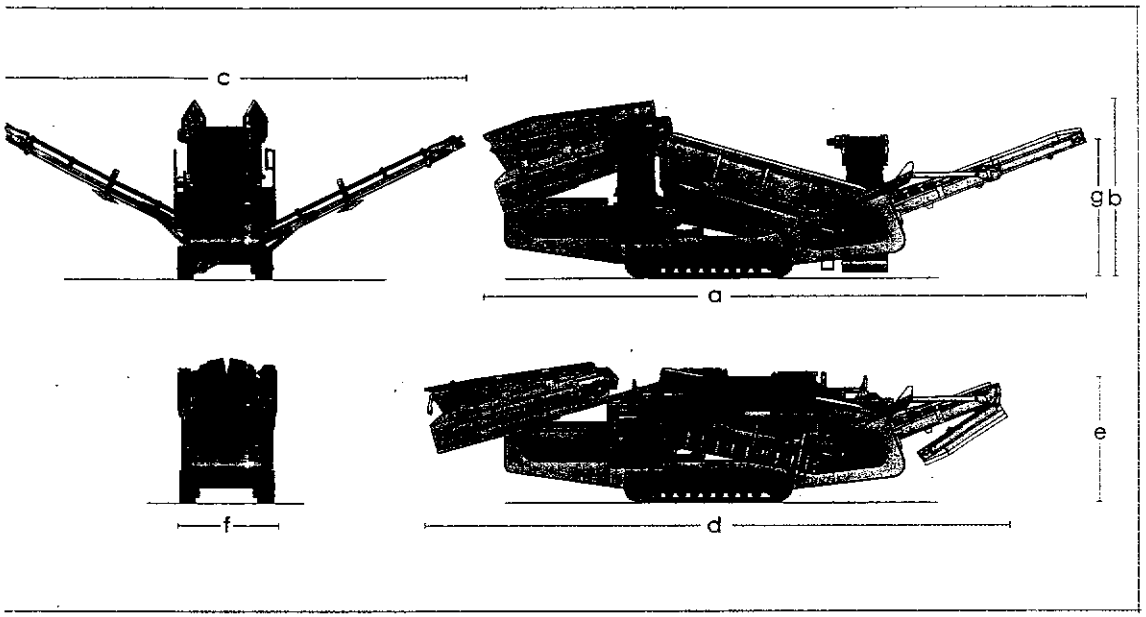
CURRENT SPECIFICATIONS AS OF JANUARY, 2005

BANDIT INDUSTRIES, INC.

6750 Millbrook Road • Remus, MI 49340
Phone: (800) 952-0178 or (989) 561-2270
Fax: (989)561-2273
E-mail: sales@banditchippers.com
Website: www.banditchippers.com

YOUR AUTHORIZED BANDIT DEALER

E-7 screen specification



	machine dimensions		
a	length (working)	14.4m	47' 3"
b	height (working)	4.2m	13' 11"
c	width (working)	13.1m	43' 1"
d	length (transport)	14m	45' 11"
e	height (transport)	2.8m	9'
f	width (transport)	2.5m	8' 6"
g	tail conveyor height	3.1m	10' 5"
h	side conveyor height	3.3m	10' 11"

conveyor dimensions		
hopper conveyor width	1.3m	4'6"
collect conveyor width	1.2m	48"
rear conveyor width	1.2m	48"
side conveyor width	0.8m	32"

THE QUEEN'S AWARDS FOR ENTERPRISE: INTERNATIONAL TRADE 2005

ISO 9001:2000 REGISTERED COMPANY CERTIFICATE No. 04/4585

Extec Screens & Crushers Ltd.
Hearthcote Road,
Swadlincote, Derbyshire.
DE11 9DU. England.
Telephone: +44 (0) 1283 212121
Fax. +44 (0) 1283 217342

Extec Inc.
P.O. Box 355, Essington,
PA. 19029-0355
Telephone: +1 610 521 1448
Telephone: 800-44-SCREEN
Facsimile: +1 610521 0919

Extec Sales & Distribution
Australia PTY
No.12 Tait Street,
Smithfield, NSW, 2464
Telephone: 61 (2) 96092922
Fax: 61 (2) 96092933

excellence through technology

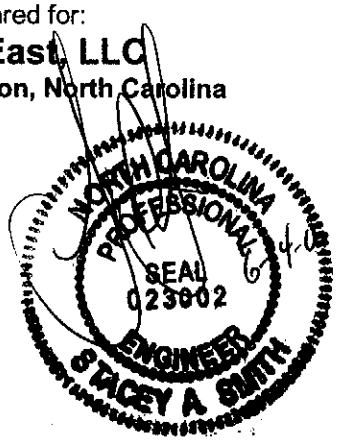
E-mail: info@extecscreens.com Website: www.extecscreens.com

broch cat no. 0142 ena

Stormwater Management Plan

Flowers LCID Recycling Center
Johnston County, North Carolina

Prepared for:
42 East, LLC
Clayton, North Carolina



June 2006

G.N. Richardson & Associates, Inc.
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

42 EAST, LLC
FLOWERS LCID RECYCLING CENTER
STORMWATER MANAGEMENT PLAN

TABLE OF CONTENTS

42 EAST, LLC
FLOWERS LCID RECYCLING CENTER

STORMWATER STATEMENT

1.0 GENERAL INFORMATION

In accordance with Johnston County Stormwater Management Ordinance (Ordinance), this statement has been provided to address the remedial development of the Flowers Land Clearing and Inert Debris (LCID) landfill.

1.1 Facility Name:

Flowers LCID Recycling Center

1.2 Site Location:

1021 Motorcycle Road
Clayton, North Carolina 27527

See **Figure 1** for Vicinity Map

1.3 District:

The site is located **outside** the Environmentally Sensitive Overlay District as shown on the Johnston County GIS site.

1.4 Owner:

42 East, LLC
Attn.: Gary Lynch
P.O. Box 20012
Raleigh, North Carolina 27619
email: ccraftsmen@myway.com
Phone: (919) 553-3187 Fax: (919) 553-9910

1.5 Engineer:

G.N. Richardson & Associates, Inc.
Attn.: Stacey A. Smith, P.E.
14 N. Boylan Ave.
Raleigh, North Carolina 27607
email: stacey@gnra.com
Phone: (919) 828-0577 Fax: (919) 828-3894

2.0 PROJECT DESCRIPTION

The existing site is the location of an un-permitted LCID dump site which is currently under a compliance action[1] with the NCDENR (see **Attachment 1**). Almost 90% of the site is covered in LCID waste with a veneer soil cover. Mr. Gary Lynch of 42 East, LLC recently purchased the property and has agreed to remediate through excavation and processing of the existing landfill under 15A NCAC 13B 0.300. The proposed project will remediate the site to its near original conditions. The construction and operation of the processing facility will require the disturbance of approximately 16 acres to complete the remedial efforts at the site. Refer to **Figures 1** through **4** for additional information regarding drainage areas, soil maps, zoning, and hydrologic features.

3.0 IMPERVIOUS AREA

3.1 Pre-Development Conditions:

Since the proposed site is a remedial measure, the pre-develoment conditions are considered the worst case for the site. The site will require additional all weather surfacing (aggregate base course) for access to the LCID processing area, to establish pads for processing equipment, and to establish pads for loading and hauling equipment. The breakdown of impervious area is as follows:

- Access roads : 24,250 sq.ft
- Processing area: 27,000 sq.ft
- Loading areas: 5,000 sq.ft

Total : 56,250 sq.ft or 1.29 ac or 8% of the total area.

Therefore, in the pre-developed (remedial) condition, the impervious area is below the allowable impervious area of 60% for non-residential applications and is below 15% for the 1 yr. 24 hr. storm limitations. Land dedication will not be required.

3.2 Post-Development Conditions:

Post-development of the property will return the site to its near original condition (prior to the landfill). Therefore, the final development will only include impervious area for the access road leading into the site. All other pads will be removed. The breakdown of impervious area is as follows:

- Access roads : 18,250 sq.ft

Total : 18,250 sq.ft or 0.42 ac or 2.6% of the total area.

---

[1] Correspondence dated February 10, 2004 from Mr. Ben Barnes,.NCDENR to Mr. Billy R. Flowers, Flowers LCID regarding Notice of Violation issued July 18, 2003.

4.0 STORMWATER RUNOFF REDUCTION

The proposed remedial development includes three (3) drainage areas. All flow from each area is diverted to a detention basin as follows:

Sediment Basin A: 10.1 acres
Sediment Basin B: 4.5 acres
Sediment Trap: 1.2 acres

Since the total impervious area is less than 15%, peak discharge attenuation is not required. However, the development of the project will reduce the total runoff into the detention basins from the 1 yr - 24 hour storm as follows:

Pre-Development: 0.71 cfs
Post-Development: 0.32 cfs or a 55% reduction

Furthermore, the detention basins will generally store 99% of the inflow during this storm event. Supporting calculations are provided as **Attachment 2**.

5.0 NITROGEN LOADING

In accordance with Neuse River Basin - Nutrient Sensitive Waters Management Strategy (15A NCAC 2B .0235), new developments must reduce nitrogen loading.

5.1 Pre-Development Condition:

Figure 4.2.02 (Method 2) of the Ordinance was used to calculate nitrogen loading for the proposed development as shown below:

Type of Land Cover	Area (Acres)	TN Export Coeff. (lbs/ac/yr)	TN export from use (lbs/yr)
Permanently protected undisturbed open space	---	0.6	---
Permanently protected managed open space	15	1.2	18
Impervious Surfaces	1.29	21.2	27.3
Subtotal	***16***	**---**	***45.3***
Total N-loading	**2.83**		

The total nitrogen export for the remedial development is less than the 3.6 lbs/ac

limit under this condition. Therefore, offset payments are unnecessary.

5.2 Post-Development Condition:

Figure 4.2.02 (Method 2) of the Ordinance was used to calculate nitrogen loading for the proposed development as shown below:

Type of Land Cover	Area (Acres)	TN Export Coeff. (lbs/ac/yr)	TN export from use (lbs/yr)
Permanently protected undisturbed open space	---	0.6	---
Permanently protected managed open space	15	1.2	18
Impervious Surfaces	0.42	21.2	8.9
Subtotal	***16***	**—**	***26.9***
Total N-loading	**1.68**		

The final development of the site will result in a reduction of nitrogen loading from the site from pre-development conditions.

6.0 EXISTING DRAINAGE WAYS

The proposed development does not include any natural drainage ways through the site. However, the entrance road crosses a drainage feature not identified on USGS mapping. The development will not disturb this area other than to improve the drainage under the site access road by increasing the culvert size. Refer to **Figures 1** through **4** for additional information regarding drainage areas, soil maps, zoning, and hydrologic features.

7.0 STORMWATER MANAGEMENT SYSTEMS

The stormwater management systems have been designed in accordance with the North Carolina Erosion and Sediment Control Planning and Design Manual by the NCDENR Division of Land Resources. The overall site hydrologic model was performed by using the HydroCAD modeling software. An Erosion and Sedimentation Control Plan (**Attachment 3**) has been prepared for the site and was submitted to Land Quality on June 2, 2006. A copy of the plan approval will be submitted to Johnston County. The site was designed based on both the 10 year and 25 year storm events. Additionally, the 100 year storm was used for spillway structures.

7.1 Drainage Channels

A summary of peak flow for the drainage channels are as follows:

Channels	10 year - 24 hour Storm Event	
	Peak Flow (CFS)	Maximum Velocity (FPS)
Channel - 1	4.69	3.5
Channel - 2	4.10	4.6
Channel - 3	3.65	4.1
Channel - 4	1.46	2.1
Channel - 5	1.35	2.9

7.2 Culverts

Hydraulic Structure	10 year - 24 hour Storm Event	25 year - 24 hour Storm Event
	Peak Flow (CFS)	Peak Flow (CFS)
Roadway Culvert	1.22	3.71

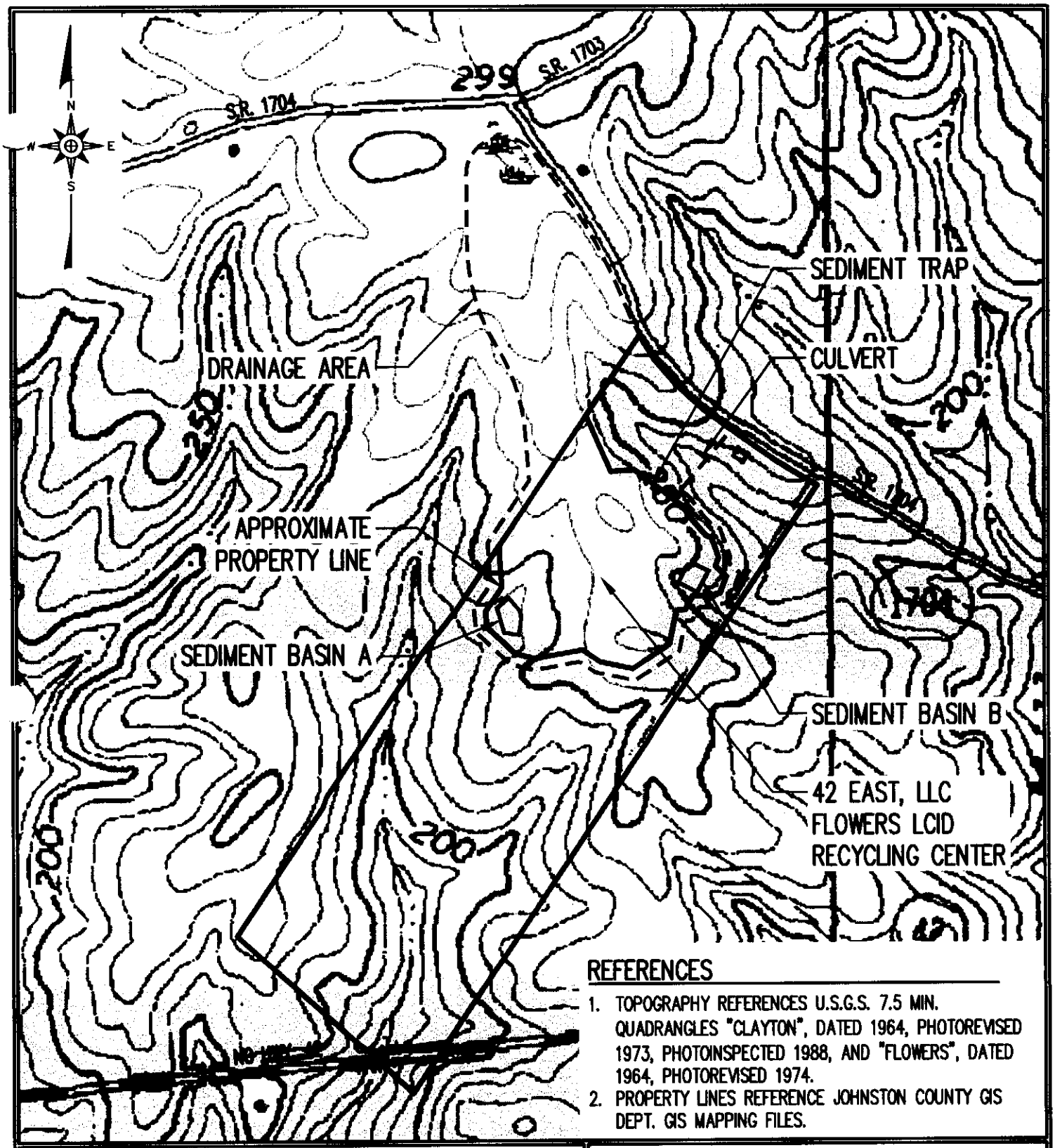
7.3 Sediment Basins and Sediment Trap

Hydraulic Structure	25 year - 24 hour Storm Event	100 year - 24 hour Storm Event
	Peak Flow (CFS)	Peak Flow (CFS)
Sediment Basin A	1.86	11.84
Sediment Basin B	0.51	1.48
Sediment Trap	1.47	3.41

All supporting calculations are provided as **Attachment 2**.

Refer to **Figures 1** through **4** for additional information regarding drainage areas, soil maps, zoning, and hydrologic features.

Figures



REFERENCES

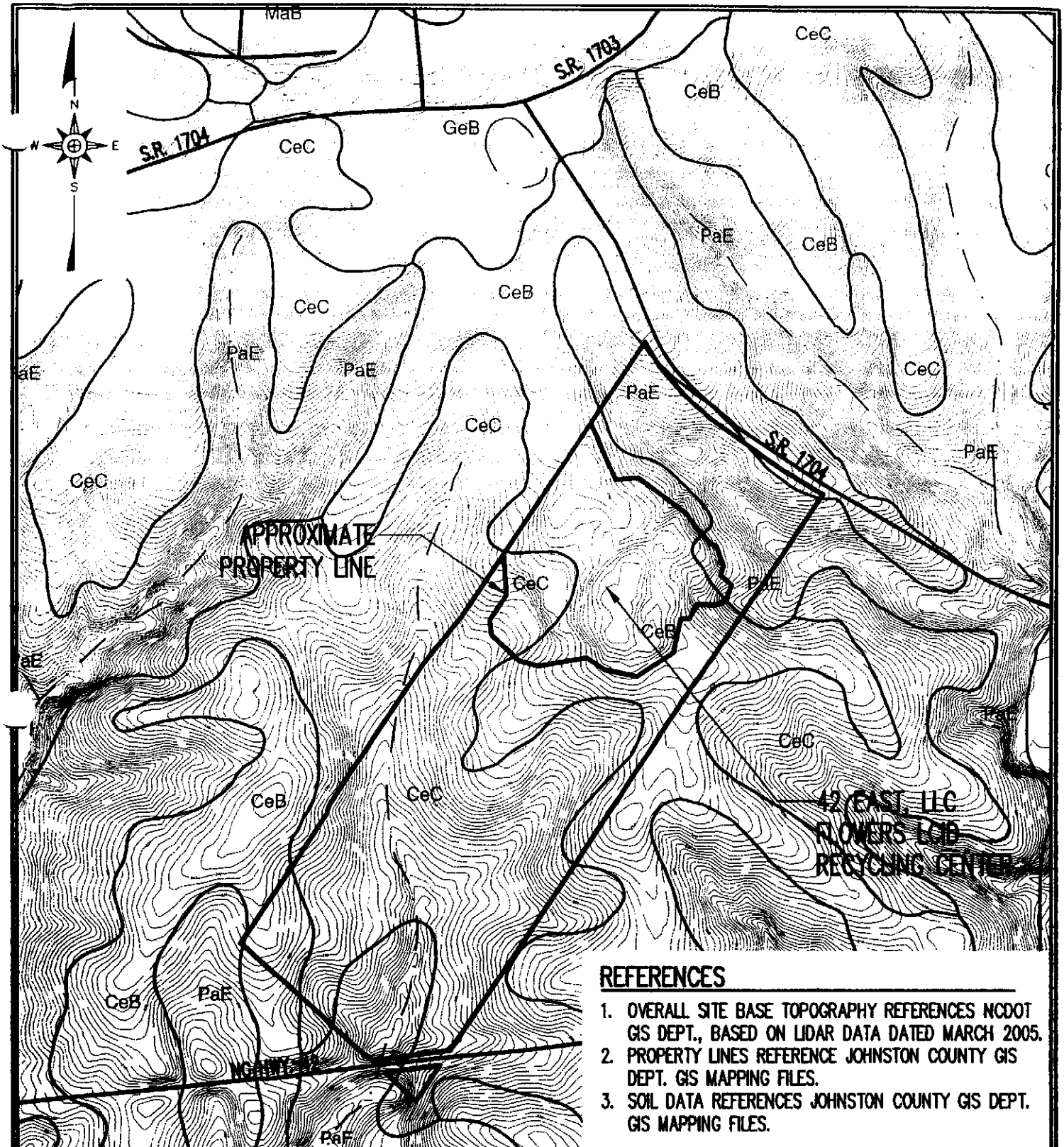
1. TOPOGRAPHY REFERENCES U.S.G.S. 7.5 MIN. QUADRANGLES "CLAYTON", DATED 1964, PHOTOREVISED 1973, PHOTOINSPECTED 1988, AND "FLOWERS", DATED 1964, PHOTOREVISED 1974.
2. PROPERTY LINES REFERENCE JOHNSTON COUNTY GIS DEPT. GIS MAPPING FILES.

USGS QUADRANGLE MAP WITH DRAINAGE AREAS AND DRAINAGE STRUCTURES

G. N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.gnra.com
ph: 919-828-0577
fax: 919-828-3899

SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
1"= 600'	C.T.J.	K.B.S.	Jun. 2006	FLOWERS 06-1	1	FLOWERS-A0014

G:\CAD\42 East LLC\Flowers 06-1\sheets\FLOWERS-A0014.dwg, 7/6/2006 1:27:02 PM



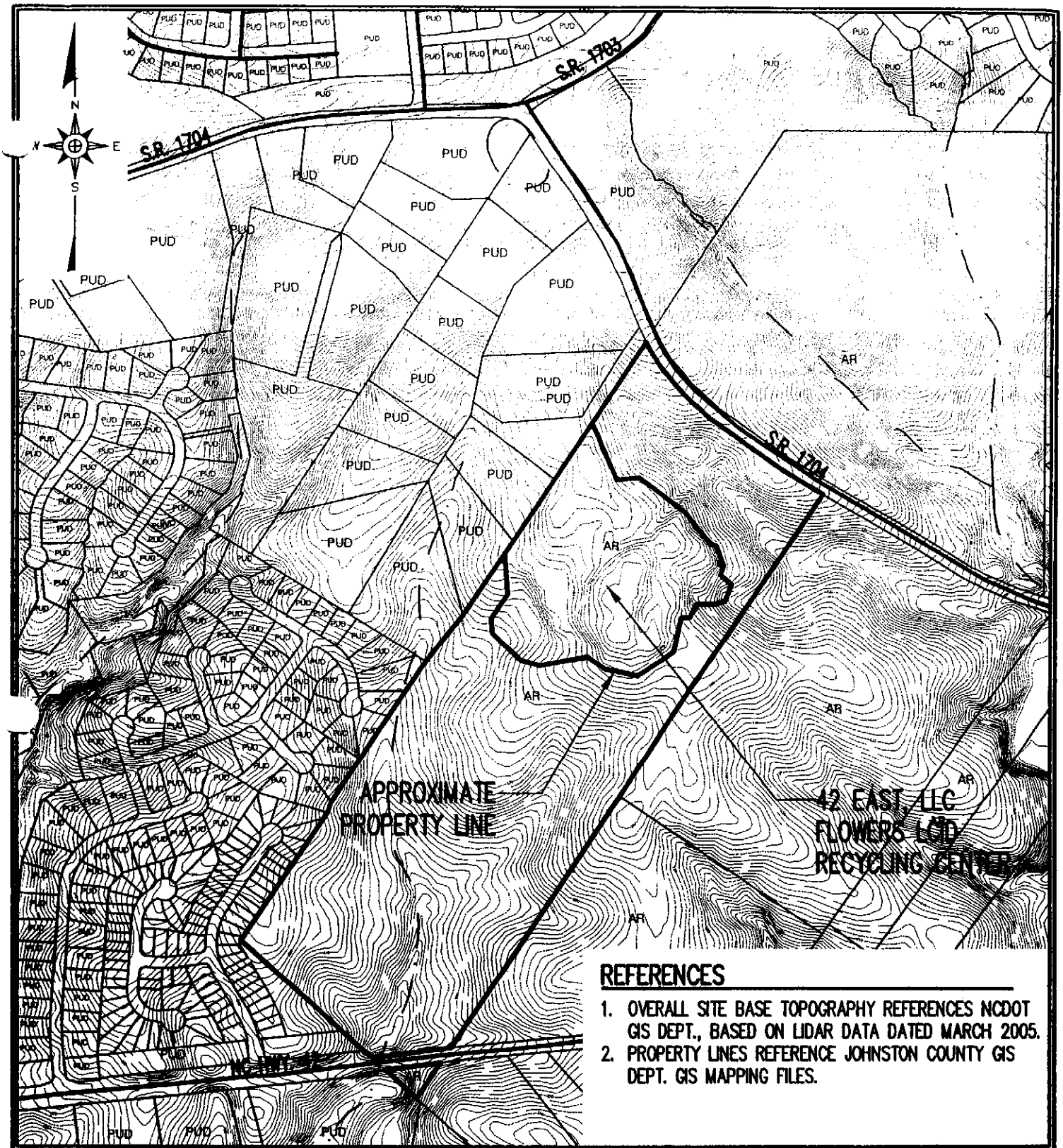
REFERENCES

1. OVERALL SITE BASE TOPOGRAPHY REFERENCES NCDOT GIS DEPT., BASED ON LIDAR DATA DATED MARCH 2005.
2. PROPERTY LINES REFERENCE JOHNSTON COUNTY GIS DEPT. GIS MAPPING FILES.
3. SOIL DATA REFERENCES JOHNSTON COUNTY GIS DEPT. GIS MAPPING FILES.

USDA-NRCS SOIL SURVEY MAP

G. N. RICHARDSON & ASSOCIATES, INC.
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.gnra.com
ph: 919-828-0577
fax: 919-828-3899

SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
1"= 600'	C.T.J.	K.B.S.	Jun. 2006	FLOWERS 06-1	2	FLOWERS-A0015



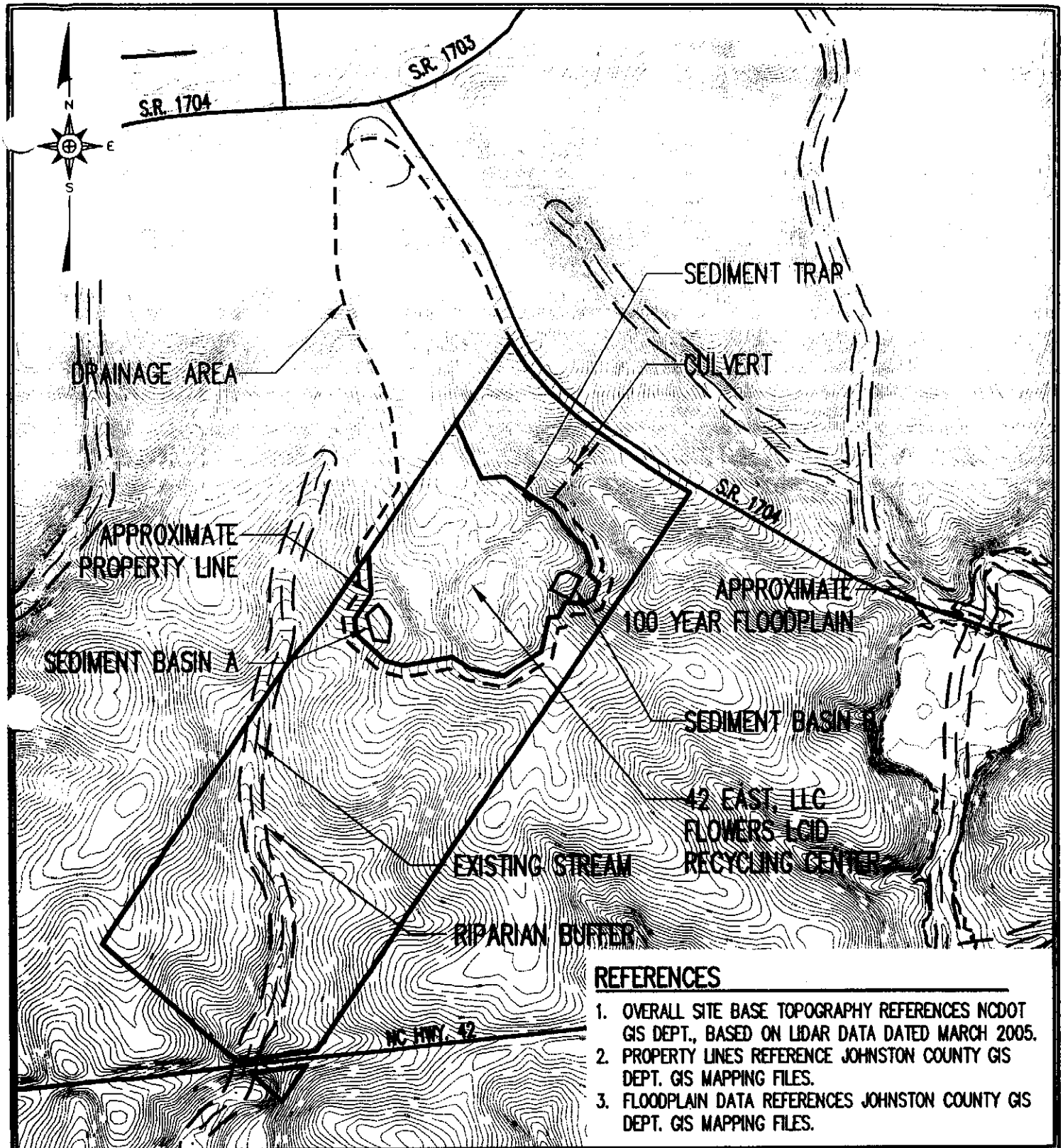
REFERENCES

1. OVERALL SITE BASE TOPOGRAPHY REFERENCES NCDOT GIS DEPT., BASED ON LIDAR DATA DATED MARCH 2005.
2. PROPERTY LINES REFERENCE JOHNSTON COUNTY GIS DEPT. GIS MAPPING FILES.

LOCAL ZONING MAP

G. N. RICHARDSON & ASSOCIATES, INC.
14 N. Boylan Ave. ph: 919-828-0577
Raleigh, N.C. 27603 www.gnra.com fax: 919-828-3899

SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
1"= 600'	C.T.J.	K.B.S.	Jun. 2006	FLOWERS 06-1	3	FLOWERS-A0016



REFERENCES

1. OVERALL SITE BASE TOPOGRAPHY REFERENCES NCDOT GIS DEPT., BASED ON LIDAR DATA DATED MARCH 2005.
2. PROPERTY LINES REFERENCE JOHNSTON COUNTY GIS DEPT. GIS MAPPING FILES.
3. FLOODPLAIN DATA REFERENCES JOHNSTON COUNTY GIS DEPT. GIS MAPPING FILES.

SITE TOPOGRAPHIC MAP WITH HYDROLOGIC FEATURES

G. N. RICHARDSON & ASSOCIATES, INC.
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.gnra.com
ph: 919-828-0577
fax: 919-828-3899

SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
1"= 600'	C.T.J.	K.B.S.	Jun. 2006	FLOWERS 06-1	4	FLOWERS-A0017

Attachment 1

Notice of Violation

mf CW

1000 83

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Interim Director

DIVISION OF WASTE MANAGEMENT
July 18, 2003

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
Mr. Billy R. Flowers owner Flowers LCID
4300 Highway 42 East
Clayton, North Carolina 27520

RE: **Notice of Violation**
Notified LCID Landfill
Johnston County

Dear Mr. Flowers:

Pursuant to North Carolina General Statute 130A-22(a) and to 15A North Carolina Administrative Code 13B, I conducted an inspection on July 16, 2003 of the Flowers notified LCID Landfill located on Motorcycle Rd.in Johnston County, North Carolina. The inspection found Flowers LCID to be in violation of certain requirements contained in the North Carolina Solid Waste Management Rules, codified at 15A N.C. Admin. Code 13B, specifically:

15A N.C. Admin. Code 13B. 0563**OPERATIONAL REQUIREMENTS FOR LAND CLEARING AND INERT DEBRIS LANDFILLS** (1)(b) which states that "An individual permit from the Division of Solid Waste Management is not required for Land Clearing and Inert Debris landfills that meet all of the following conditions:
The total disposal area is under two acres in size. "

15A N.C. Admin. Code 13B. 0566**OPERATIONAL REQUIREMENTS FOR LAND CLEARING AND INERT DEBRIS LANDFILLS (7)** which states that "Provisions for a ground cover sufficient to restrain erosion must be accomplished within 30 working days or 120 calendar days upon completion of any phase of landfill development".

The Flowers LCID is in violation of 15A N.C. Admin. Code 13B in that:
Waste material has been placed in the facility without cover in an area measuring up to 14 acres in size. This determination was made using aerial photographs.

Based upon the foregoing, Flowers LCID must take the following actions by October 17, 2003, to correct all violations stated in this Notice of Violation, and otherwise be in compliance with the North Carolina Solid Waste Management Rules, codified at 15A N.C. Admin. Code 13B:

I. As of July 18, 2003 cease accepting all waste at this facility until the conditions listed in this Notice of Violation have been met.

II. Remove all solid waste from the site except that which is classified as land clearing and inert debris and transport to a solid waste disposal facility permitted to receive this type of waste. Provide receipts from the disposal of this waste to the Division.

III. Compact and consolidate all other land clearing and inert debris waste if possible into an area measuring less than two acres in size and cover with one foot of suitably compacted soil and stabilize with grass.

IV. Stabilize the area where the waste was removed by grading and seeding.

Note: Burning of waste is not permitted and will invite further compliance actions.

Pursuant to N.C.G.S. 130A-22(a) and 15A N.C. Admin. Code 13B, Section .0701 - .0707, an administrative penalty of up to $5,000.00 per day may be assessed for violations of the Solid Waste Law or Regulations.

If you have any questions concerning this matter, please contact me at (919) 571 4700.

Sincerely,

Ben Barnes

Ben Barnes
Waste Management Specialist
Solid Waste Section (skip 2 lines)

cc: Mark Poindexter, Field Operations Branch Head
Mark Fry, Eastern Area Supervisor
John Holley, Supervisor Division of Land Quality

Attachment 2

Stormwater Management Plan - Calculations

HydroCAD Analysis
for 1-Year Storm Event
(Pre-Developed Condition)

Subcatchment 4S: Drainage Area-A6

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
11.500	36	Woods, Fair, HSG A

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

Subcatchment 8S: Drainage Area - A4

Runoff = 0.02 cfs @ 12.56 hrs, Volume= 0.010 af, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
1.500	49	50-75% Grass cover, Fair, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	300	0.0400	0.4		**Lag/CN Method,**

Subcatchment 9S: Drainage Area -A3

Runoff = 0.11 cfs @ 12.10 hrs, Volume= 0.029 af, Depth> 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
2.800	49	50-75% Grass cover, Fair, HSG A
0.200	76	Gravel roads, HSG A
3.000	51	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	250	0.0810	0.5		**Lag/CN Method,**

Subcatchment 10S: Draninage Area-A2

Runoff = 0.09 cfs @ 12.47 hrs, Volume= 0.033 af, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
3.900	49	50-75% Grass cover, Fair, HSG A
0.200	76	Gravel roads, HSG A
4.100	50	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	400	0.0700	0.5		**Lag/CN Method,**

Subcatchment 12S: Drainage Area-A1

Runoff = 0.56 cfs @ 12.19 hrs, Volume= 0.096 af, Depth> 0.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
5.200	49	50-75% Grass cover, Fair, HSG A
1.200	76	Gravel roads, HSG A
6.400	54	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.7	540	0.0550	0.5		**Lag/CN Method,**

Subcatchment 23S: Drainage Area -5

Runoff = 0.10 cfs @ 12.10 hrs, Volume= 0.016 af, Depth> 0.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
1.100	49	50-75% Grass cover, Fair, HSG A
0.100	98	Paved parking & roofs
1.200	53	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	170	0.0400	0.3		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.80"

Reach 5R: Channel 3

Inflow Area = 3.000 ac, Inflow Depth > 0.12" for 1 Yr-24 Hrs event
Inflow = 0.11 cfs @ 12.10 hrs, Volume= 0.029 af
Outflow = 0.09 cfs @ 12.47 hrs, Volume= 0.029 af, Atten= 12%, Lag= 22.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.0 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 6.6 min

Peak Depth= 0.02' @ 12.37 hrs
Capacity at bank full= 293.54 cfs
Inlet Invert= 262.00', Outlet Invert= 244.00'
4.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 377.0' Slope= 0.0477 '/'

Reach 11R: Channel -1

Inflow Area = 6.400 ac, Inflow Depth > 0.18" for 1 Yr-24 Hrs event
Inflow = 0.56 cfs @ 12.19 hrs, Volume= 0.096 af
Outflow = 0.45 cfs @ 12.47 hrs, Volume= 0.094 af, Atten= 20%, Lag= 17.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.6 fps, Min. Travel Time= 8.9 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 14.0 min

Peak Depth= 0.07' @ 12.32 hrs
Capacity at bank full= 215.95 cfs
Inlet Invert= 256.00', Outlet Invert= 234.50'
4.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 832.0' Slope= 0.0258 '/'

Reach 13R: Channel - 5

Inflow Area = 1.200 ac, Inflow Depth > 0.16" for 1 Yr-24 Hrs event
Inflow = 0.10 cfs @ 12.10 hrs, Volume= 0.016 af
Outflow = 0.09 cfs @ 12.22 hrs, Volume= 0.016 af, Atten= 12%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.1 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 4.5 min

Peak Depth= 0.03' @ 12.16 hrs
Capacity at bank full= 232.34 cfs
Inlet Invert= 264.00', Outlet Invert= 255.00'
3.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 230.0' Slope= 0.0391 '/'

Reach 22R: Channel - 4

Inflow Area = 1.500 ac, Inflow Depth > 0.08" for 1 Yr-24 Hrs event
Inflow = 0.02 cfs @ 12.56 hrs, Volume= 0.010 af
Outflow = 0.02 cfs @ 13.12 hrs, Volume= 0.010 af, Atten= 4%, Lag= 33.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.8 fps, Min. Travel Time= 7.9 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 7.9 min

Peak Depth= 0.01' @ 12.99 hrs
Capacity at bank full= 453.75 cfs
Inlet Invert= 251.00', Outlet Invert= 244.00'
4.00' x 3.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 22.00'
Length= 370.0' Slope= 0.0189 '/'

Reach 27R: Channel - 2

Inflow Area = 4.100 ac, Inflow Depth > 0.10" for 1 Yr-24 Hrs event
Inflow = 0.09 cfs @ 12.47 hrs, Volume= 0.033 af
Outflow = 0.09 cfs @ 12.70 hrs, Volume= 0.033 af, Atten= 5%, Lag= 13.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.1 fps, Min. Travel Time= 6.5 min
Avg. Velocity = 1.1 fps, Avg. Travel Time= 6.5 min

Peak Depth= 0.02' @ 12.58 hrs
Capacity at bank full= 335.85 cfs
Inlet Invert= 262.00', Outlet Invert= 235.50'
4.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 424.0' Slope= 0.0625 '/'

Pond 1P: Basin-A

Inflow Area = 10.500 ac, Inflow Depth > 0.14" for 1 Yr-24 Hrs event
Inflow = 0.52 cfs @ 12.50 hrs, Volume= 0.126 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 232.41' @ 20.00 hrs Surf.Area= 4,257 sf Storage= 5,493 cf
Flood Elev= 238.00' Surf.Area= 9,820 sf Storage= 43,638 cf
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	231.00'	43,638 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.00	3,155	0	0
232.00	3,907	3,531	3,531
234.00	5,605	9,512	13,043
236.00	7,585	13,190	26,233
238.00	9,820	17,405	43,638

Device	Routing	Invert	Outlet Devices
#1	Primary	231.00'	**18.0" x 100.0' long Culvert - Barrel** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 0.00' S= 2.3100 '/' Cc= 0.900 n= 0.013
#2	Device 1	233.00'	**0.7" Vert. Side Opening X 16.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#3	Device 1	235.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Primary	236.00'	**12.0' long x 20.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=231.00' (Free Discharge)
- **1=Culvert - Barrel** (Controls 0.00 cfs)
  - **2=Side Opening** (Controls 0.00 cfs)
  - **3=Riser** (Controls 0.00 cfs)
- **4=Emergency Spillway** (Controls 0.00 cfs)

Pond 3P: Roadway Culvert

Inflow Area = 12.700 ac, Inflow Depth > 0.01" for 1 Yr-24 Hrs event
Inflow = 0.02 cfs @ 16.22 hrs, Volume= 0.006 af
Outflow = 0.02 cfs @ 16.22 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min
Primary = 0.02 cfs @ 16.22 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 232.05' @ 16.22 hrs
Flood Elev= 234.00'
Plug-Flow detention time= (not calculated: no plugs found)
Center-of-Mass det. time= 0.0 min (1,063.0 - 1,063.0)

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**24.0" x 140.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 230.00' S= 0.0143 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=0.02 cfs @ 16.22 hrs HW=232.05' (Free Discharge)
- **1=Culvert** (Barrel Controls 0.02 cfs @ 1.2 fps)

Pond 6P: Basin - B

Inflow Area = 4.500 ac, Inflow Depth > 0.10" for 1 Yr-24 Hrs event
Inflow = 0.10 cfs @ 12.56 hrs, Volume= 0.039 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.57' @ 20.00 hrs Surf.Area= 2,670 sf Storage= 1,680 cf
Flood Elev= 250.00' Surf.Area= 8,140 sf Storage= 28,540 cf
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	28,540 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	2,300	0	0
242.00	3,600	5,900	5,900
244.00	5,450	9,050	14,950
246.00	8,140	13,590	28,540

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" x 80.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 0.00' S= 3.0000 '/' Cc= 0.900 n= 0.013
#2	Device 1	241.00'	**0.7" Vert. Side Opening A X 16.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#3	Device 1	244.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Primary	245.00'	**12.0' long x 20.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' (Free Discharge)
- **1=Culvert** (Controls 0.00 cfs)
- **2=Side Opening A** (Controls 0.00 cfs)
- **3=Riser** (Controls 0.00 cfs)
- **4=Emergency Spillway** (Controls 0.00 cfs)

Pond ST-1: Sed. Trap 1

Inflow Area = 1.200 ac, Inflow Depth > 0.16" for 1 Yr-24 Hrs event
Inflow = 0.09 cfs @ 12.22 hrs, Volume= 0.016 af
Outflow = 0.02 cfs @ 16.22 hrs, Volume= 0.006 af, Atten= 79%, Lag= 240.2 min
Primary = 0.02 cfs @ 16.22 hrs, Volume= 0.006 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 256.02' @ 16.22 hrs Surf.Area= 498 sf Storage= 437 cf
Plug-Flow detention time= 300.6 min calculated for 0.006 af (37% of inflow)
Center-of-Mass det. time= 162.1 min (1,063.0 - 900.9)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	2,194 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
255.00	350	0	0
256.00	494	422	422
258.00	836	1,330	1,752
258.50	933	442	2,194

Device	Routing	Invert	Outlet Devices
#1	Primary	256.00'	**Rock Dam** Head (feet) 0.00 0.50 1.00 1.50 2.00 Disch. (cfs) 0.000 0.410 1.750 4.220 8.000
#2	Secondary	258.50'	**143.0 deg x 10.0' long Sharp-Crested Vee/Trap Weir** C= 2.47

Primary OutFlow Max=0.02 cfs @ 16.22 hrs HW=256.02' (Free Discharge)
↑—**1=Rock Dam** (Custom Controls 0.02 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
↑—**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

HydroCAD Analysis
for 1-Year Storm Event
(Post-Developed Condition)

Subcatchment 4S: Drainage Area-A6

[49] Hint: Tc<2dt may require smaller dt
[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
11.500	36	Woods, Fair, HSG A

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

Subcatchment 8S: Drainage Area - A4

Runoff = 0.02 cfs @ 12.56 hrs, Volume= 0.010 af, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
1.500	49	50-75% Grass cover, Fair, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	300	0.0400	0.4		**Lag/CN Method,**

Subcatchment 9S: Drainage Area -A3

Runoff = 0.11 cfs @ 12.10 hrs, Volume= 0.029 af, Depth> 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
2.800	49	50-75% Grass cover, Fair, HSG A
0.200	76	Gravel roads, HSG A
3.000	51	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	250	0.0810	0.5		**Lag/CN Method,**

Subcatchment 10S: Draninage Area-A2

Runoff = 0.09 cfs @ 12.47 hrs, Volume= 0.033 af, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
3.900	49	50-75% Grass cover, Fair, HSG A
0.200	76	Gravel roads, HSG A
4.100	50	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	400	0.0700	0.5		**Lag/CN Method,**

Subcatchment 12S: Drainage Area-A1

Runoff = 0.13 cfs @ 12.56 hrs, Volume= 0.049 af, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
5.800	49	50-75% Grass cover, Fair, HSG A
0.200	76	Gravel roads, HSG A
6.000	50	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	540	0.0550	0.5		**Lag/CN Method,**

Subcatchment 23S: Drainage Area -5

Runoff = 0.02 cfs @ 12.50 hrs, Volume= 0.008 af, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr-24 Hrs Rainfall=3.20"

Area (ac)	CN	Description
1.200	49	50-75% Grass cover, Fair, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	170	0.0400	0.3		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.80"

Reach 5R: Channel 3

Inflow Area = 3.000 ac, Inflow Depth > 0.12" for 1 Yr-24 Hrs event
Inflow = 0.11 cfs @ 12.10 hrs, Volume= 0.029 af
Outflow = 0.09 cfs @ 12.47 hrs, Volume= 0.029 af, Atten= 12%, Lag= 22.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.0 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 6.6 min

Peak Depth= 0.02' @ 12.37 hrs
Capacity at bank full= 293.54 cfs
Inlet Invert= 262.00', Outlet Invert= 244.00'
4.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 377.0' Slope= 0.0477 '/'

Reach 11R: Channel -1

Inflow Area = 6.000 ac, Inflow Depth > 0.10" for 1 Yr-24 Hrs event
Inflow = 0.13 cfs @ 12.56 hrs, Volume= 0.049 af
Outflow = 0.12 cfs @ 13.07 hrs, Volume= 0.046 af, Atten= 9%, Lag= 31.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.0 fps, Min. Travel Time= 14.5 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 17.7 min

Peak Depth= 0.03' @ 12.83 hrs
Capacity at bank full= 215.95 cfs
Inlet Invert= 256.00', Outlet Invert= 234.50'
4.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 832.0' Slope= 0.0258 '/'

Reach 13R: Channel - 5

Inflow Area = 1.200 ac, Inflow Depth > 0.08" for 1 Yr-24 Hrs event
Inflow = 0.02 cfs @ 12.50 hrs, Volume= 0.008 af
Outflow = 0.02 cfs @ 12.67 hrs, Volume= 0.008 af, Atten= 3%, Lag= 10.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.9 fps, Min. Travel Time= 4.5 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 4.5 min

Peak Depth= 0.01' @ 12.59 hrs
Capacity at bank full= 232.34 cfs
Inlet Invert= 264.00', Outlet Invert= 255.00'
3.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 230.0' Slope= 0.0391 '/'

Reach 22R: Channel - 4

Inflow Area = 1.500 ac, Inflow Depth > 0.08" for 1 Yr-24 Hrs event
Inflow = 0.02 cfs @ 12.56 hrs, Volume= 0.010 af
Outflow = 0.02 cfs @ 13.12 hrs, Volume= 0.010 af, Atten= 4%, Lag= 33.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.8 fps, Min. Travel Time= 7.9 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 7.9 min

Peak Depth= 0.01' @ 12.99 hrs
Capacity at bank full= 453.75 cfs
Inlet Invert= 251.00', Outlet Invert= 244.00'
4.00' x 3.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 22.00'
Length= 370.0' Slope= 0.0189 '/'

Reach 27R: Channel - 2

Inflow Area = 4.100 ac, Inflow Depth > 0.10" for 1 Yr-24 Hrs event
Inflow = 0.09 cfs @ 12.47 hrs, Volume= 0.033 af
Outflow = 0.09 cfs @ 12.70 hrs, Volume= 0.033 af, Atten= 5%, Lag= 13.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.1 fps, Min. Travel Time= 6.5 min
Avg. Velocity = 1.1 fps, Avg. Travel Time= 6.5 min

Peak Depth= 0.02' @ 12.58 hrs
Capacity at bank full= 335.85 cfs
Inlet Invert= 262.00', Outlet Invert= 235.50'
4.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 424.0' Slope= 0.0625 '/'

Pond 1P: Basin-A

Inflow Area = 10.100 ac, Inflow Depth > 0.09" for 1 Yr-24 Hrs event
Inflow = 0.20 cfs @ 13.01 hrs, Volume= 0.079 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 231.97' @ 20.00 hrs Surf.Area= 3,887 sf Storage= 3,435 cf
Flood Elev= 238.00' Surf.Area= 9,820 sf Storage= 43,638 cf
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	231.00'	43,638 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.00	3,155	0	0
232.00	3,907	3,531	3,531
234.00	5,605	9,512	13,043
236.00	7,585	13,190	26,233
238.00	9,820	17,405	43,638

Device	Routing	Invert	Outlet Devices
#1	Primary	231.00'	**18.0" x 100.0' long Culvert - Barrel** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 0.00' S= 2.3100 '/' Cc= 0.900 n= 0.013
#2	Device 1	233.00'	**0.7" Vert. Side Opening X 16.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#3	Device 1	235.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Primary	236.00'	**12.0' long x 20.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=231.00' (Free Discharge)
- **1=Culvert - Barrel** (Controls 0.00 cfs)
  - **2=Side Opening** (Controls 0.00 cfs)
  - **3=Riser** (Controls 0.00 cfs)
- **4=Emergency Spillway** (Controls 0.00 cfs)

Pond 3P: Roadway Culvert

Inflow Area = 12.700 ac, Inflow Depth = 0.00" for 1 Yr-24 Hrs event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 232.00' @ 0.00 hrs
Flood Elev= 234.00'
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**24.0" x 140.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 230.00' S= 0.0143 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=232.00' (Free Discharge)
- **1=Culvert** (Controls 0.00 cfs)

Pond 6P: Basin - B

Inflow Area = 4.500 ac, Inflow Depth > 0.10" for 1 Yr-24 Hrs event
Inflow = 0.10 cfs @ 12.56 hrs, Volume= 0.039 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.57' @ 20.00 hrs Surf.Area= 2,670 sf Storage= 1,680 cf
Flood Elev= 250.00' Surf.Area= 8,140 sf Storage= 28,540 cf
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	28,540 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	2,300	0	0
242.00	3,600	5,900	5,900
244.00	5,450	9,050	14,950
246.00	8,140	13,590	28,540

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" x 80.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 0.00' S= 3.0000 '/' Cc= 0.900 n= 0.013
#2	Device 1	241.00'	**0.7" Vert. Side Opening A X 16.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#3	Device 1	244.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Primary	245.00'	**12.0' long x 20.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' (Free Discharge)
- **1=Culvert** (Controls 0.00 cfs)
  - **2=Side Opening A** (Controls 0.00 cfs)
  - **3=Riser** (Controls 0.00 cfs)
- **4=Emergency Spillway** (Controls 0.00 cfs)

Pond ST-1: Sed. Trap 1

[61] Hint: Submerged 9% of Reach 13R bottom

Inflow Area = 1.200 ac, Inflow Depth > 0.08" for 1 Yr-24 Hrs event
Inflow = 0.02 cfs @ 12.67 hrs, Volume= 0.008 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 255.82' @ 20.00 hrs Surf.Area= 468 sf Storage= 347 cf
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	2,194 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
255.00	350	0	0
256.00	494	422	422
258.00	836	1,330	1,752
258.50	933	442	2,194

Device	Routing	Invert	Outlet Devices
#1	Primary	256.00'	**Rock Dam** Head (feet) 0.00 0.50 1.00 1.50 2.00 Disch. (cfs) 0.000 0.410 1.750 4.220 8.000
#2	Secondary	258.50'	**143.0 deg x 10.0' long Sharp-Crested Vee/Trap Weir** C= 2.47

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
↑—**1=Rock Dam** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
↑—**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

HydroCAD Analysis
for 100-Year Storm Event

Pond 1P: Basin-A

Inflow Area = 10.100 ac, Inflow Depth > 2.01" for 100 Year-24 hrs event
Inflow = 22.60 cfs @ 12.16 hrs, Volume= 1.689 af
Outflow = 11.84 cfs @ 12.39 hrs, Volume= 1.233 af, Atten= 48%, Lag= 14.0 min
Primary = 11.84 cfs @ 12.39 hrs, Volume= 1.233 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 235.67' @ 12.39 hrs Surf.Area= 7,255 sf Storage= 24,036 cf
Flood Elev= 238.00' Surf.Area= 9,820 sf Storage= 43,638 cf
Plug-Flow detention time= 113.8 min calculated for 1.233 af (73% of inflow)
Center-of-Mass det. time= 43.8 min (871.2 - 827.4)

Volume	Invert	Avail.Storage	Storage Description
#1	231.00'	43,638 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.00	3,155	0	0
232.00	3,907	3,531	3,531
234.00	5,605	9,512	13,043
236.00	7,585	13,190	26,233
238.00	9,820	17,405	43,638

Device	Routing	Invert	Outlet Devices
#1	Primary	231.00'	**18.0" x 100.0' long Culvert - Barrel** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 0.00' S= 2.3100 '/' Cc= 0.900 n= 0.013
#2	Device 1	233.00'	**0.7" Vert. Side Opening X 16.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#3	Device 1	235.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Primary	236.00'	**12.0' long x 20.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=11.75 cfs @ 12.39 hrs HW=235.66' (Free Discharge)
- **1=Culvert - Barrel** (Passes 11.75 cfs of 16.83 cfs potential flow)
  - **2=Side Opening** (Orifice Controls 0.63 cfs @ 7.4 fps)
  - **3=Riser** (Weir Controls 11.11 cfs @ 2.7 fps)
- **4=Emergency Spillway** (Controls 0.00 cfs)

Pond 3P: Roadway Culvert

Inflow Area = 12.700 ac, Inflow Depth > 0.92" for 100 Year-24 hrs event
Inflow = 15.61 cfs @ 12.00 hrs, Volume= 0.975 af
Outflow = 15.61 cfs @ 12.00 hrs, Volume= 0.975 af, Atten= 0%, Lag= 0.0 min
Primary = 15.61 cfs @ 12.00 hrs, Volume= 0.975 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 233.69' @ 12.00 hrs
Flood Elev= 234.00'
Plug-Flow detention time= 0.0 min calculated for 0.975 af (100% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**24.0" x 140.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 230.00' S= 0.0143 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=15.61 cfs @ 12.00 hrs HW=233.69' (Free Discharge)
└─**1=Culvert** (Inlet Controls 15.61 cfs @ 5.5 fps)

Pond 6P: Basin - B

Inflow Area = 4.500 ac, Inflow Depth > 2.02" for 100 Year-24 hrs event
Inflow = 13.02 cfs @ 12.06 hrs, Volume= 0.756 af
Outflow = 1.48 cfs @ 12.83 hrs, Volume= 0.498 af, Atten= 89%, Lag= 46.3 min
Primary = 1.48 cfs @ 12.83 hrs, Volume= 0.498 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 244.11' @ 12.83 hrs Surf.Area= 5,600 sf Storage= 15,710 cf
Flood Elev= 250.00' Surf.Area= 8,140 sf Storage= 28,540 cf
Plug-Flow detention time= 192.6 min calculated for 0.498 af (66% of inflow)
Center-of-Mass det. time= 111.6 min (933.1 - 821.6)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	28,540 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	2,300	0	0
242.00	3,600	5,900	5,900
244.00	5,450	9,050	14,950
246.00	8,140	13,590	28,540

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" x 80.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 0.00' S= 3.0000 '/' Cc= 0.900 n= 0.013
#2	Device 1	241.00'	**0.7" Vert. Side Opening A X 16.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#3	Device 1	244.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Primary	245.00'	**12.0' long x 20.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.46 cfs @ 12.83 hrs HW=244.11' (Free Discharge)
├─**1=Culvert** (Passes 1.46 cfs of 15.60 cfs potential flow)
│ ├─**2=Side Opening A** (Orifice Controls 0.69 cfs @ 8.1 fps)
│ └─**3=Riser** (Weir Controls 0.77 cfs @ 1.1 fps)
└─**4=Emergency Spillway** (Controls 0.00 cfs)

Pond ST-1: Sed. Trap 1

Inflow Area = 1.200 ac, Inflow Depth > 2.02" for 100 Year-24 hrs event
Inflow = 3.73 cfs @ 12.06 hrs, Volume= 0.202 af
Outflow = 3.41 cfs @ 12.11 hrs, Volume= 0.191 af, Atten= 8%, Lag= 3.0 min
Primary = 3.41 cfs @ 12.11 hrs, Volume= 0.191 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 257.34' @ 12.11 hrs Surf.Area= 723 sf Storage= 1,311 cf
Plug-Flow detention time= 32.1 min calculated for 0.190 af (94% of inflow)
Center-of-Mass det. time= 12.8 min (833.5 - 820.8)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	2,194 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
255.00	350	0	0
256.00	494	422	422
258.00	836	1,330	1,752
258.50	933	442	2,194

Device	Routing	Invert	Outlet Devices
#1	Primary	256.00'	**Rock Dam** Head (feet) 0.00 0.50 1.00 1.50 2.00 Disch. (cfs) 0.000 0.410 1.750 4.220 8.000
#2	Secondary	258.50'	**143.0 deg x 10.0' long Sharp-Crested Vee/Trap Weir** C= 2.47

Primary OutFlow Max=3.34 cfs @ 12.11 hrs HW=257.32' (Free Discharge)
↑**1=Rock Dam** (Custom Controls 3.34 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
↑**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Attachment 3

Erosion and Sedimentation Control Plan

Erosion And Sedimentation Control Plan

Flowers LCID Recycling Center
Johnston County, North Carolina

Prepared for:
42 East, LLC
Clayton, North Carolina

To the Attention of:
Mr. Gary Lynch

GNRA Project No. Flowers-06-1

Kinjal B. Shah
Staff Engineer

Stacey A. Smith, P.E.
Senior Engineer

NORTH CAROLINA PROFESSIONAL SEAL 023002 ENGINEER STACEY A SMITH

May 2006

G.N. Richardson & Associates, Inc.
Engineering and Geological Services
14 N. Boylan Avenue
Raleigh, North Carolina 27603

42 EAST, LLC.
FLOWERS LCID RECYCLING CENTER

EROSION AND SEDIMENTATION CONTROL PLAN

TABLE OF CONTENTS

42 EAST, LLC
FLOWERS LCID RECYCLING CENTER

EROSION AND SEDIMENTATION CONTROL PLAN

1.0 NARRATIVE

1.1 Project Description

42 East, LLC plans to construct and operate a Land Clearing and Inert Debris (LCID) Processing facility over the existing Flowers' LCID Landfill located off of Motorcycle Road near Flowers, North Carolina as shown in **Figure 1**.

The proposed use for the site includes remediation of an un-permitted LCID landfill owned by the late Mr. Billy Flowers[1]. The site is currently under a Notice of Violation by the North Carolina Department of Environment and Natural Resoures (NCDENR) Division of Waste Management[2]. Mr. Gary Lynch of 42 East, LLC recently purchased the property and has agreed to remediate through excavation and processing of the existing landfill under 15A NCAC 13B 0.300. The final development of the property will include returning the site to its original condition (prior to LCID placement).

The construction and operation of the processing facility will require the disturbance of approximately 16 acres to complete the remedial efforts at the site. This plan discusses both the initial and long term (final) erosion and sedimentation control measures used on this project.

1.2 Contact Information

1.2.1 Engineer: For questions regarding this erosion and sedimentation control plan, please contact the following:

G.N. Richardson & Associates, Inc.
Attn.: Stacey A. Smith, P.E.
14 N. Boylan Ave.
Raleigh, NC 27607
Phone: (919) 828-0577
Fax: (919) 828-3894.

---

1 Correspondence dated February 10, 2004 from Mr. Ben Barnes, NCDENR to Mr. Billy R. Flowers, Flowers LCID regarding Notice of Violation issued July 18, 2003.

2 Notice of Violation dated July 18, 2003 from Mr. Ben Barnes, NCDENR to Mr. Billy R. Flowers, Flowers LCID.

1.2.2 Owner: The owner of the site and the person to contact should sediment control issues arise during the land-disturbing activity is as follows:

42 East, LLC
Attn.: Gary Lynch, Owner
P.O. Box 20012
Raleigh NC
Phone: (919) 553-3187
Fax: (919) 553-9910

1.3 Existing Site Conditions

The existing site is the location of an un-permitted LCID dump site which is currently under a compliance action with the NCDENR (see attached Notice of Violation). Almost 90% of the site is covered in LCID waste with a veneer soil cover. The proposed project will remediate to its near original conditions. The existing ground surface elevation on from Elevation 270 at the middle portion of the project area to Elevation 230 at the northeast edge of the project area and generally consists or a sparsely vegetated soil cover. The site is located in the Neuse River Basin.

1.4 Adjacent Areas

The proposed facility is surrounded by property owned by 42 East, LLC and to the west by the Garden at Flowers Plantation residential community. Mill Creek lies just to the east of the proposed site which is the receiving stream from the northeast portions of the property and an un-named tributary to the southwest receives stormwater from the remaining portions of the property. The site is accessed from Motorcycle road to the north. Generally the area surrounding the site consists of wooded areas, however, the trend is increasing residential developments.

1.5 Site Soils Information

The native surficial soils at the site fall under the categories of Cecil series (CeB, CeC) according to the GIS Website for Johnston County as shown in **Figure 2**. Generally, this series varies from sandy loam (surficial area) to clayey loam to loam with depth. Based on permeability of surficial sandy loam, a hydrologic soil group (HSG) "A" is considered. for purposes of runoff calculations.

2.0 DESIGN GUIDELINES AND PROCEDURES

The erosion and sediment control design for the landfill was conducted based on guidelines and procedures as set forth in the following references:

1. HydroCAD Software Solutions, LLC (2005), HydroCAD Stormwater Modeling System Owner's Manual - Version 7.1, Chocorua, NH.

2. North Carolina Division of Land Resources (1988 and 1993 Update), North Carolina Erosion & Sediment Control Planning & Design Manual, Raleigh, NC.

3. Johnston County Dept. of Utilities (August 2004), Johnston County Storm water Design Manual,

4. Malcom, H. Rooney (1989 & 2003 Supplement), Elements of Urban Stormwater Design, NC State Univ., Raleigh, NC.

3.0 RUNOFF CALCULATIONS

All stormwater flow volumes were calculated using the HydroCAD 7.10 computer program (utilizing USDA-NRCS (SCS) methods) based on a 10-year 24-hour storm event. Rainfall quantities and/or intensities used in the analyses were derived from NDAA-35 and TP-40 data and have been included in **Appendix A**. Drainage areas were determined using a planimeter and/or AutoCAD on topographic sheets of the project area. For each drainage area, runoff curve numbers (SCS methods) and/or runoff coefficients were selected based on ground cover conditions. Times of concentration were calculated by HydroCAD using SCS methods.

The peak discharge from the 10-year 24-hour storm event and 25-year 24-hour storm event were evaluated for post developed conditions by HydroCAD. Supporting calculations are provided in **Appendix A.**

TABLE 1: SUMMARY OF RUNOFF VALUES

Discharge Point	Peak Discharge Rate	
	10 Year Storm Event	25 Year Storm Event
Basin A	0.51 CFS	1.86 CFS
Basin B	0.37 CFS	0.51 CFS
Sediment Trap 1	0.67 CFS	1.47 CFS

4.0 EROSION AND SEDIMENTATION CONTROL MEASURES

The following erosion and sedimentation control measures are to be constructed as part of the proposed construction/remediation. **Appendices A, B, and C** to this plan include calculations, technical specifications, and plans and details for each of these measures, respectively. Note that erosion and sedimentation control measures are designated with letters or numbers. Sediment basins and sediment trap are designated by letters, while others are designated by numbers.

In most cases, the following erosion and sedimentation control measures were designed using the final drainage areas which were found to represent a worst case for design. Each calculation indicates what condition was used in the analysis. The general concept in the construction/remediation of the site is to create a perimeter stormwater control program where all runoff is directed to permanent sediment basins or the temporary sediment trap.

4.1 Sediment Basins

There are two (2) permanent Sediment Basins (Basins A and B) which will serve the site. Sediment Basin A is to be located on the east side of the project area and Sediment Basin B is to be located to the south-west side of the project area.

Sediment basin design is subject to several requirements. Per ESCPDM, sediment basins must provide a basin volume of 1,800 ft^3/acre of disturbed area. Additionally, permanent basins include principal (riser/barrel) spillways and emergency (weir-type) spillways. The principal spillways must have a capacity of 0.2 ft^3 /second/acre of drainage area at one (1) foot of driving head. The crest of the emergency spillways is set one (1) foot above the invert of the riser and must pass the peak run-off from the design storm event with one (1) foot of freeboard to the crest of the berm. Each component of sediment basin (riser/barrel assembly, emergency spillway) were modeled with the HydroCAD computer program and a spreadsheet was used to verify these requirements as well as maintaining a minimum settling efficiency of 70% for the 10 Year storm event.

4.2 Drainage Channels

Drainage channel calculations were conducted by HydroCAD to determine the normal depth of flow based on the peak discharge from the design storm by assuming channel dimensions/slope(s). Manning's number is considered typically 0.025 for all channels by assuming "grass channel" in HydroCAD. Channel linings were chosen, as appropriate, based on the calculated velocity. For grass channel (with good cover and proper maintenance), the allowable velocity is 5 fps. (Ref: Elements of stormwater design by Dr. Roony Malcom) and in the bare earth condition the allowable velocity is 2.5 fps.

4.3 Temporary Sediment Trap

The temporary sediment trap was designed in accordance with ESCPDM Section 6.60. The main consideration in the design of a temporary sediment trap is that the disturbed drainage area contributing flow to the basin not exceed 5 acres. Other design criteria include a basin volume of 1,800 ft^3/acre of disturbed area and a spillway weir length sized to pass the 10-year peak storm as given in Table 6.60a, ESCPDM. Other design requirements of temporary sediment trap design also meet the criteria of Section 6.60. Each temporary sediment trap was modeled with the HydroCAD computer program and a spreadsheet was used to verify the design requirements

4.4 Culverts

There is one (1) culvert which will replace an existing six (6) inch pipe at the site to convey flow beneath the roadwayn with a 24 inch reinforced concrete pipe. The culvert was designed by HydroCAD to determine the maximum headwater elevation. Discharge from the culvert was designed with a stone filter berm placed around the inlet to trap sediment.

4.5 Silt Fence

Silt fencing design was based on criteria set forth in ESCPDM, Section 6.62.

4.6 Vegetative Stabilization

Vegetative stabilization will be in accordance with the seeding schedule in the project specifications (provided as an attachment to this plan). The seeding schedule was based on Table 6.11k of ESCPDM which is applicable to this site.

5.0 SCHEDULE FOR IMPLEMENTATION

All erosion control measures will be placed before any remedial land disturbance or LCID processing begins on the site. All areas reaching final elevations will be stabilized and vegetated.

Disturbed areas left inactive between any phase of grading shall be temporarily seeded within 15 working days or 30 calender days, whichever is shorter. Provisions for permanent groundcover must be accomplished on exposed slopes 21 calendar days, and in remaining areas within 15 working days or 90 calender days, whichever is shorter.

6.0 MAINTENANCE AND SEDIMENT DISPOSAL

All erosion and sedimentation control facilities shall be inspected at least once every seven calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period. A rain gauge shall be maintained on the site and a record of the rainfall amounts and dates shall be kept properly.

Once land disturbance has begun on the site, stormwater runoff discharges shall be inspected by observation for stormwater discharge characteristics to evaluate the effectiveness of the erosion and sediment control measures incorporating Best Management Practices (BMP's). If any visible sedimentation is leaving the disturbed limits of the site, corrective action shall be taken immediately to control the discharge of sediments outside the disturbed limits.

All sediments which are removed from erosion and sedimentation control measures will be disposed of in an approved manner at a location to be designated by the Engineer in such a manner that further erosion and sedimentation will not occur.

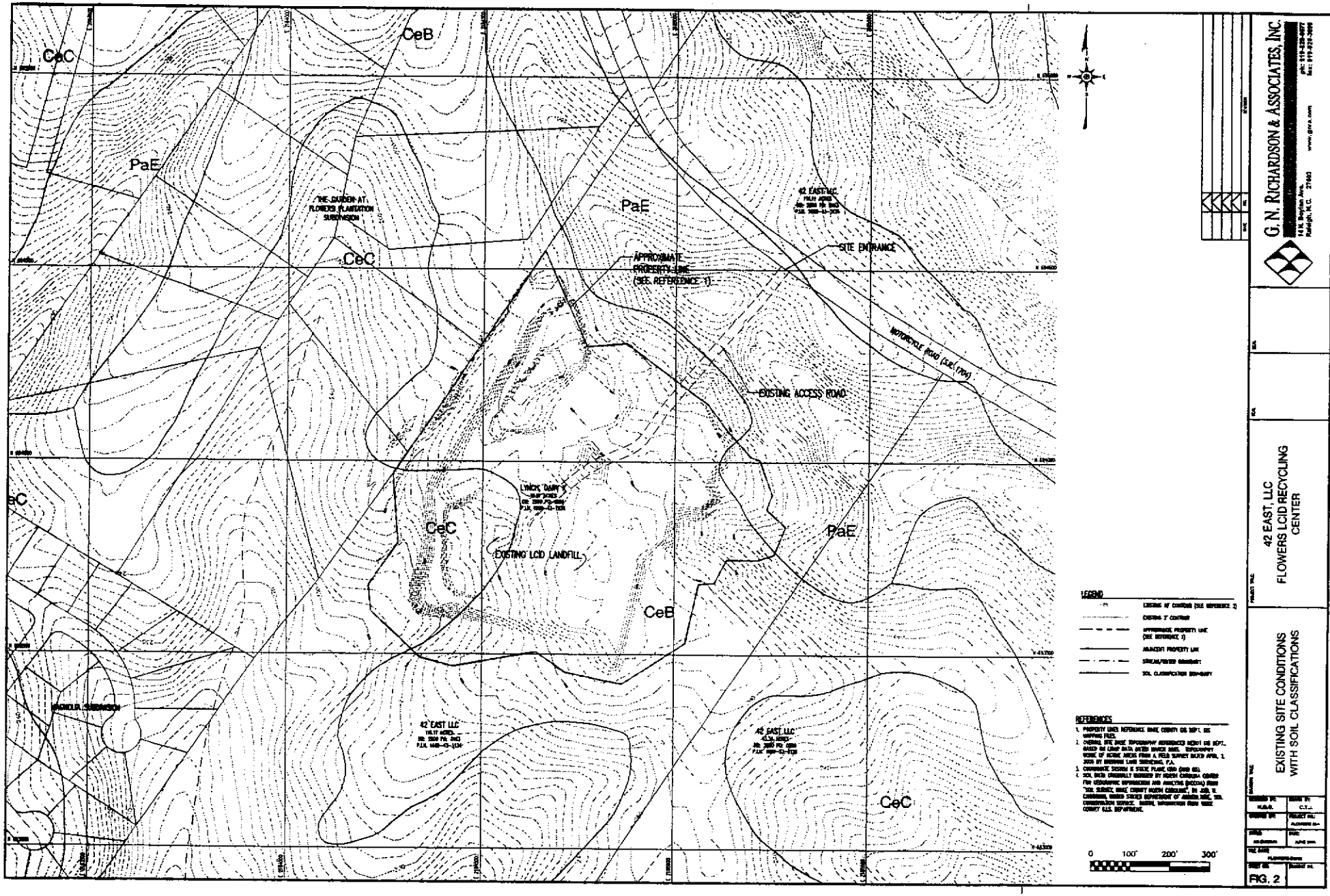
Figures

SITE LOCATION MAP

G. N. RICHARDSON & ASSOCIATES, INC.
14 N. Boylan Ave.
Raleigh, N.C. 27603
www.gnra.com
ph: 919-828-0577
fax: 919-828-3899

SCALE:	DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.	FIGURE NO.	FILE NAME
AS SHOWN	C.T.J.		Jun. 2006	FLOWERS 06-1	1	FLOWERS-A0013

G:\CADV42 East LLC\Flowers 06-1\sheets\FLOWERS-A0013.dwg. 7/5/2006 5:00:13 PM


CeC
CeB
PaE
THE GARDEN AT FLOWERS PLANTATION SUBDIVISION
42 EAST, LLC
SITE ENTRANCE
APPROXIMATE PROPERTY LINE (SEE REFERENCE 1)
MOTORCYCLE ROAD (U.S. 70W)
EXISTING ACCESS ROAD
LYNCH, DAIRY
EXISTING LCID LANDFILL
MAGNOLIA SUBDIVISION
42 EAST LLC
42 EAST, LLC
LEGEND
EXISTING 10' CONTOUR (SEE REFERENCE 2)
EXISTING 2' CONTOUR
APPROXIMATE PROPERTY LINE (SEE REFERENCE 1)
ADJACENT PROPERTY LINE
STREAM/RIVER BOUNDARY
SOIL CLASSIFICATION BOUNDARY
REFERENCES
1. PROPERTY LINES REFERENCE WAKE COUNTY GIS DEPT. GIS MAPPING FILES.
2. OVERALL SITE BASE TOPOGRAPHY REFERENCED FROM GIS DEPT., BASED ON LIDAR DATA DATED MARCH 2005. TOPOGRAPHY NOTED OF ACTIVE AREAS FROM A FIELD SURVEY DATED APRIL 3, 2006 BY BRENNAN LAND SURVEYING, P.A.
3. COORDINATE SYSTEM IS STATE PLANE, NAD 1983 (NAD 83).
4. SOIL DATA ORIGINALLY SOURCED BY NORTH CAROLINA CENTER FOR GEOGRAPHIC INFORMATION AND ANALYSIS (NCCGIA) FROM "SOIL SURVEY, WAKE COUNTY NORTH CAROLINA", BY JOE W. CARPENTER, UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE. DIGITAL INFORMATION FROM WAKE COUNTY GIS DEPARTMENT.
0
100'
200'
300'
G. N. RICHARDSON & ASSOCIATES, INC.
42 EAST, LLC
FLOWERS LCID RECYCLING CENTER
EXISTING SITE CONDITIONS WITH SOIL CLASSIFICATIONS
FIG. 2

Attachment

Notice of Violation
July 18, 2003

N0080

NCDENR

North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor | William G. Ross Jr., Secretary

THE DIVISION OF WASTE MANAGEMENT
February 10, 2004

Received
FEB 2004
Waste Management

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
Mr. Billy R. Flowers, Owner, Flowers' LCID
4300 Highway 42 East
Clayton, North Carolina 27520

Re: **Notice of Violation issued July 18, 2003**
Notified LCID
Johnston Co.

Dear Mr. Flowers,

On July 18, 2003 you were sent a Notice Of Violation concerning conditions found at your Notified Land Clearing and Inert Debris (LCID) Landfill which is located on Motorcycle Rd. in Johnston Co. An inspection on July 16, 2003 revealed that land clearing waste material has been disposed of in an area measuring approximately 14 acres in size and that the waste was not covered. (LCID Notification facilities are limited to a maximum of two acres of waste capacity). The July 18, 2003 NOV required that you:

I. As of July 18, 2003 cease accepting all waste at this facility until the conditions listed in this Notice of Violation have been met.
II. Remove all solid waste from the site except that which is classified as land clearing and inert debris and transport to a solid waste disposal facility permitted to receive this type of waste. Provide receipts from the disposal of this waste to the Division.
III. Compact and consolidate all other land clearing and inert debris waste if possible into an area measuring less than two acres in size and cover with one foot of suitably compacted soil and stabilize with grass.
IV. Stabilize the area where the waste was removed by grading and seeding.

On September 24, 2003 an inspection revealed that the facility has been closed but that no action has been taken to comply with items II, III, and IV listed above. The deadline for the completion of the above listed conditions was October 17, 2003.

On October 10, 2003 during a meeting on site you requested an extension to complete the above listed actions. During an inspection of the site on November 14, 2003 I observed that some work has been done but much work still needs to be done in order to bring the site into compliance.

1628 Mail Service Center, Raleigh North Carolina 27699-1628
Phone: 919-571-4700 \ Fax: 919-571-4718 \ Internet: www.enr.state.nc.us/ENR

Complete the following recordation procedure (a condition of closing the site with the waste in place shall be recordation of the waste disposal location by the property owner with the Register of Deeds in the county where the land lies):

A Submit to the Section an entire copy of the property deed giving the complete legal description of the property as it is registered in the index of the county where the land is located. The description will be either by metes and bounds, or by reference to a recorded plat map.

B. Submit to the Section a plat of the land prepared by a registered land surveyor in accordance with N.C.G.S. 47-30; the map must show:

1. Name of owner, property lines, north arrow, scale, and bearings and distances taken from the deed;

2. Disposal area delineated, with the words Solid Waste Disposal Site written on the map;

3. Certification and seal by a registered land surveyor.

Note: Be sure plat ties to U.S.G.S. monument in accordance with N.C.G.S. 47-30(f)(9).

[Mail items A. and B. above to Ben Barnes, Solid Waste Section, Department of Environment and Natural Resources, 1628 Mail Service Center Raleigh North Carolina 27699-1628,

The Section will prepare a Notice of Closed Unpermitted Solid Waste Disposal Site, which the landowner(s) shall sign and acknowledge in the form prescribed by N.C.G.S. 47-38 through 47-43.

1. The landowner(s) must file the Closure Notice, with the map attached where appropriate, with the Register of Deeds in the county where the land is located. If the map is too large to be reduced legibly to legal size, it shall be recorded in the map index, and the Closure Notice shall reference the separately recorded plat.

2. The Register of Deeds shall record the Notice in the Grantor Index under the name(s) of the owner(s) of the land.

On December 3, 2003 you were sent a final notice giving you until January 17, 2004 to comply with the NOV dated July 18, 2003.

On January 13, 2004 I visited the site and saw evidence of further work but observed that the site was still far from being in compliance.

On February 5, 2004 Mark Fry and I visited the site and observed that most of the material remains on site covering an area much greater than 2 acres. Due to the size of the site it does not appear to be feasible to remove the remaining waste or to compact the waste into an area no larger than 2 acres. Therefore by March 22, 2004 you must:

Close the site in compliance with regulations concerning open dumps, Section .0502 of 15A N.C. Admin. Code 13B, as follows:

I. Remove all solid waste, other than the land clearing and inert debris, and dispose of at the Johnston County Construction and Demolition Landfill. Metal debris can and should be recycled if possible through reputable scrap metal dealers.

II. Mail copies of all landfill and scrap metal company receipts to me at Solid Waste Section, Department of Environment and Natural Resources, 1628 Mail Service Center, Raleigh, North Carolina 27699-1628.

III. Compact the remainder of the waste as densely as possible into a mound leaving 2:1 or lesser slopes along all sides of the waste pile. Cover the waste (top and side slopes) with one foot or more of suitable, compacted earth.

IV. Implement erosion control measures by grading and seeding the site.

V. Post signs stating that no dumping is allowed, and prevent unauthorized entry to the site by repairing the entrance gate.

3. After recording, the Register of Deeds shall mail the original notice instrument (affixed with Registers seal) which notes the book, page number, and date of recording to: Mark Fry, Eastern Area Supervisor, Solid Waste Section, Department of Environment and Natural Resources, 225 Green Street, Suite 714 Fayetteville, North Carolina 28301

4. After all other requirements of this Notice of Violation have been met, and the Section has received the original Closure Notice from the Register of Deeds, the Section will issue a closure letter.

Pursuant to N.C.G.S. 130A-22(a) and to 15A N.C. Admin. Code 13B, Sections .0701 - .0707, an administrative penalty of up to $5,000.00 per day may be assessed for violations of the North Carolina Solid Waste Management Law or Regulations, or for violation of any order issued thereunder.

If you have any questions, I can be reached at (919) 571 4700

Sincerely,
Ben Barnes

Ben Barnes

Waste Management Specialist
Solid Waste Section
Raleigh Regional Office

cc: Mark Poindexter, Field Operations Branch Head
Mark Fry, Eastern District Supervisor

Appendix A

Erosion & Sedimentation Control Calculations

42 EAST, LLC
FLOWERS LCID RECYCLING CENTER

EROSION AND SEDIMENTATION CONTROL PLAN
APPENDIX A: EROSION AND SEDIMENTATION CONTROL CALCULATIONS.

TABLE OF CONTENTS

Analysis of Design Storms

G.N. Richardson & Associates

ENGINEERING AND GEOLOGICAL SERVICES

Johnston County Landfill
Analysis of Design Storms

INPUT DATA:
LOCATION: Smithfield, NC

DURATION	2-YR P (in)	100-YR P (in)	SOURCE
5 min	0.48	0.81	NOAA HYDRO-35
15 min	1.03	1.81	NOAA HYDRO-35
60 min	1.80	3.75	NOAA HYDRO-35
2 hr to 24 hr Rainfall Events	**USER INPUT**		USWB TP-40

DEPTH-DURATION-FREQUENCY TABLE
LOCATION: Smithfield, NC

	RETURN PERIOD						
DURATION	2-YR (in)	5-YR (in)	10-YR (in)	25-YR (in)	50-YR (in)	100-YR (in)	
5 min	0.48	0.55	0.60	0.68	0.75	0.81	
10 min	0.80	0.93	1.03	1.17	1.29	1.40	
15 min	1.03	1.20	1.32	1.51	1.66	1.81	
30 min	1.41	1.72	1.94	2.26	2.51	2.76	
60 min	1.80	2.26	2.58	3.04	3.39	3.75	
2 hr	2.20	2.80	3.25	3.70	4.20	4.60	**USER INPUT**
3 hr	2.40	3.10	3.60	4.10	4.55	5.10	**USER INPUT**
6 hr	2.85	3.60	4.20	4.90	5.50	6.10	**USER INPUT**
12 hr	3.35	4.20	5.00	5.80	6.40	7.20	**USER INPUT**
24 hr	3.70	4.85	5.80	6.60	7.40	8.20	**USER INPUT**

INTENSITY-DURATION-FREQUENCY TABLE
LOCATION: Smithfield, NC

	RETURN PERIOD					
DURATION	2-YR (in/hr)	5-YR (in/hr)	10-YR (in/hr)	25-YR (in/hr)	50-YR (in/hr)	100-YR (in/hr)
5 min	**5.76**	**6.58**	**7.22**	**8.19**	**8.96**	**9.72**
10 min	**4.83**	**5.59**	**6.17**	**7.03**	**7.72**	**8.40**
15 min	**4.12**	**4.79**	**5.29**	**6.05**	**6.65**	**7.24**
30 min	**2.81**	**3.43**	**3.88**	**4.52**	**5.02**	**5.52**
60 min	**1.80**	**2.26**	**2.58**	**3.04**	**3.39**	**3.75**
2 hr	**1.10**	**1.40**	**1.63**	**1.85**	**2.10**	**2.30**
3 hr	**0.80**	**1.03**	**1.20**	**1.37**	**1.52**	**1.70**
6 hr	**0.48**	**0.60**	**0.70**	**0.82**	**0.92**	**1.02**
12 hr	**0.28**	**0.35**	**0.42**	**0.48**	**0.53**	**0.60**
24 hr	**0.15**	**0.20**	**0.24**	**0.28**	**0.31**	**0.34**

HydroCAD Analysis for 10-Year & 25-Year Storm Event

Pond 1P: Basin-A

Inflow Area =	10.100 ac,	Inflow Depth >	0.84"	for 10 Year - 24 Hour Storm event
Inflow =	7.44 cfs @	12.21 hrs,	Volume=	0.707 af
Outflow =	1.08 cfs @	13.69 hrs,	Volume=	0.565 af, Atten= 86%, Lag= 88.5 min
Primary =	1.08 cfs @	13.69 hrs,	Volume=	0.565 af
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 233.86' @ 13.69 hrs Surf.Area= 5,482 sf Storage= 12,354 cf
Flood Elev= 238.00' Surf.Area= 9,820 sf Storage= 43,638 cf
Plug-Flow detention time= 152.7 min calculated for 0.564 af (80% of inflow)
Center-of-Mass det. time= 95.0 min (945.4 - 850.4)

Volume	Invert	Avail.Storage	Storage Description
#1	231.00'	43,638 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.00	3,155	0	0
232.00	3,907	3,531	3,531
234.00	5,605	9,512	13,043
236.00	7,585	13,190	26,233
238.00	9,820	17,405	43,638

Device	Routing	Invert	Outlet Devices
#1	Primary	231.00'	**18.0" x 100.0' long Culvert - Barrel** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 0.00' S= 2.3100 '/' Cc= 0.900 n= 0.013
#2	Device 1	231.00'	**0.7" Vert. Side Opening X 12.00 columns** X 5 rows with 5.0" cc spacing C= 0.600
#3	Device 1	235.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Secondary	236.00'	**12.0' long x 20.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.08 cfs @ 13.69 hrs HW=233.85' (Free Discharge)
└**1=Culvert - Barrel** (Passes 1.08 cfs of 12.34 cfs potential flow)
  ├**2=Side Opening** (Orifice Controls 1.08 cfs @ 6.7 fps)
  └**3=Riser** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=231.00' (Free Discharge)
└**4=Emergency Spillway** (Controls 0.00 cfs)

Pond 3P: Roadway Culvert

Inflow Area =	12.700 ac,	Inflow Depth >	0.25"	for	10 Year - 24 Hour Storm event
Inflow =	1.22 cfs @	12.24 hrs,	Volume=	0.261 af	
Outflow =	1.22 cfs @	12.24 hrs,	Volume=	0.261 af,	Atten= 0%, Lag= 0.0 min
Primary =	1.22 cfs @	12.24 hrs,	Volume=	0.261 af	

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 232.40' @ 12.24 hrs
Flood Elev= 234.00'
Plug-Flow detention time= (not calculated: no plugs found)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**24.0" x 140.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 230.00' S= 0.0143 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=1.21 cfs @ 12.24 hrs HW=232.40' (Free Discharge)
1=Culvert (Inlet Controls 1.21 cfs @ 2.7 fps)

Pond 6P: Basin - B

Inflow Area =	4.500 ac,	Inflow Depth >	0.85"	for	10 Year - 24 Hour Storm event
Inflow =	4.51 cfs @	12.09 hrs,	Volume=	0.317 af	
Outflow =	0.53 cfs @	13.31 hrs,	Volume=	0.250 af,	Atten= 88%, Lag= 73.1 min
Primary =	0.53 cfs @	13.31 hrs,	Volume=	0.250 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 241.83' @ 13.31 hrs Surf.Area= 3,491 sf Storage= 5,405 cf
Flood Elev= 250.00' Surf.Area= 8,140 sf Storage= 28,540 cf
Plug-Flow detention time= 150.0 min calculated for 0.250 af (79% of inflow)
Center-of-Mass det. time= 89.1 min (933.6 - 844.5)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	28,540 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	2,300	0	0
242.00	3,600	5,900	5,900
244.00	5,450	9,050	14,950
246.00	8,140	13,590	28,540

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" x 80.0' long Culvert** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 0.00' S= 3.0000 '/' Cc= 0.900 n= 0.013
#2	Device 1	240.00'	**0.7" Vert. Side Opening X 9.00 columns** X 5 rows with 5.0" cc spacing C= 0.600

#3	Device 1	244.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Secondary	245.00'	**12.0' long x 20.0' breadth Emergency Spillway**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.53 cfs @ 13.31 hrs HW=241.83' (Free Discharge)
└─**1=Culvert** (Passes 0.53 cfs of 8.85 cfs potential flow)
  ├─**2=Side Opening** (Orifice Controls 0.53 cfs @ 4.4 fps)
  └─**3=Riser** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' (Free Discharge)
└─**4=Emergency Spillway** (Controls 0.00 cfs)

Pond ST-1: Sed. Trap 1

Inflow Area =	1.200 ac,	Inflow Depth >	0.85"	for 10 Year - 24 Hour Storm event
Inflow =	1.35 cfs @	12.09 hrs,	Volume=	0.085 af
Outflow =	0.67 cfs @	12.23 hrs,	Volume=	0.074 af, Atten= 50%, Lag= 8.8 min
Primary =	0.67 cfs @	12.23 hrs,	Volume=	0.074 af
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 256.60' @ 12.23 hrs Surf.Area= 596 sf Storage= 819 cf
Plug-Flow detention time= 64.3 min calculated for 0.074 af (87% of inflow)
Center-of-Mass det. time= 25.3 min (868.6 - 843.3)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	2,194 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
255.00	350	0	0
256.00	494	422	422
258.00	836	1,330	1,752
258.50	933	442	2,194

Device	Routing	Invert	Outlet Devices
#1	Primary	256.00'	**Rock Dam**
			Head (feet) 0.00 0.50 1.00 1.50 2.00
			Disch. (cfs) 0.000 0.410 1.750 4.220 8.000
#2	Secondary	258.50'	**143.0 deg x 10.0' long Sharp-Crested Vee/Trap Weir** C= 2.47

Primary OutFlow Max=0.66 cfs @ 12.23 hrs HW=256.59' (Free Discharge)
└─**1=Rock Dam** (Custom Controls 0.66 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
└─**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond 1P: Basin-A

Inflow Area =	10.100 ac,	Inflow Depth >	1.19"	for 25 Year-24 hrs event
Inflow =	11.92 cfs @	12.19 hrs,	Volume=	1.002 af
Outflow =	1.36 cfs @	13.80 hrs,	Volume=	0.780 af, Atten= 89%, Lag= 96.8 min
Primary =	1.36 cfs @	13.80 hrs,	Volume=	0.780 af
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 234.97' @ 13.80 hrs Surf.Area= 6,567 sf Storage= 19,453 cf
Flood Elev= 238.00' Surf.Area= 9,820 sf Storage= 43,638 cf
Plug-Flow detention time= 175.0 min calculated for 0.780 af (78% of inflow)
Center-of-Mass det. time= 112.8 min (953.3 - 840.5)

Volume	Invert	Avail.Storage	Storage Description
#1	231.00'	43,638 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.00	3,155	0	0
232.00	3,907	3,531	3,531
234.00	5,605	9,512	13,043
236.00	7,585	13,190	26,233
238.00	9,820	17,405	43,638

Device	Routing	Invert	Outlet Devices
#1	Primary	231.00'	**18.0" x 100.0' long Culvert - Barrel** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 0.00' S= 2.3100 '/' Cc= 0.900 n= 0.013
#2	Device 1	231.00'	**0.7" Vert. Side Opening X 12.00 columns** X 5 rows with 5.0" cc spacing C= 0.600
#3	Device 1	235.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Secondary	236.00'	**12.0' long x 20.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.36 cfs @ 13.80 hrs HW=234.97' (Free Discharge)
└**1=Culvert - Barrel** (Passes 1.36 cfs of 15.27 cfs potential flow)
  ├**2=Side Opening** (Orifice Controls 1.36 cfs @ 8.5 fps)
  └**3=Riser** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=231.00' (Free Discharge)
└**4=Emergency Spillway** (Controls 0.00 cfs)

Pond 3P: Roadway Culvert

Inflow Area = 12.700 ac, Inflow Depth > 0.43" for 25 Year-24 hrs event
Inflow = 3.71 cfs @ 12.02 hrs, Volume= 0.456 af
Outflow = 3.71 cfs @ 12.02 hrs, Volume= 0.456 af, Atten= 0%, Lag= 0.0 min
Primary = 3.71 cfs @ 12.02 hrs, Volume= 0.456 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 232.73' @ 12.02 hrs
Flood Elev= 234.00'
Plug-Flow detention time= 0.0 min calculated for 0.456 af (100% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**24.0" x 140.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 230.00' S= 0.0143 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=3.41 cfs @ 12.02 hrs HW=232.69' (Free Discharge)
1=Culvert (Inlet Controls 3.41 cfs @ 3.5 fps)

Pond 6P: Basin - B

Inflow Area = 4.500 ac, Inflow Depth > 1.20" for 25 Year-24 hrs event
Inflow = 7.08 cfs @ 12.07 hrs, Volume= 0.449 af
Outflow = 0.73 cfs @ 13.26 hrs, Volume= 0.365 af, Atten= 90%, Lag= 71.3 min
Primary = 0.73 cfs @ 13.26 hrs, Volume= 0.365 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 242.50' @ 13.26 hrs Surf.Area= 4,063 sf Storage= 8,166 cf
Flood Elev= 250.00' Surf.Area= 8,140 sf Storage= 28,540 cf
Plug-Flow detention time= 151.0 min calculated for 0.364 af (81% of inflow)
Center-of-Mass det. time= 95.9 min (930.5 - 834.7)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	28,540 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	2,300	0	0
242.00	3,600	5,900	5,900
244.00	5,450	9,050	14,950
246.00	8,140	13,590	28,540

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" x 80.0' long Culvert** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 0.00' S= 3.0000 '/' Cc= 0.900 n= 0.013
#2	Device 1	240.00'	**0.7" Vert. Side Opening X 9.00 columns** X 5 rows with 5.0" cc spacing C= 0.600

#3	Device 1	244.00'	**24.0" Horiz. Riser** Limited to weir flow C= 0.600
#4	Secondary	245.00'	**12.0' long x 20.0' breadth Emergency Spillway**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.73 cfs @ 13.26 hrs HW=242.50' (Free Discharge)
└─**1=Culvert** (Passes 0.73 cfs of 11.26 cfs potential flow)
  ├─**2=Side Opening** (Orifice Controls 0.73 cfs @ 6.1 fps)
  └─**3=Riser** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' (Free Discharge)
└─**4=Emergency Spillway** (Controls 0.00 cfs)

Pond ST-1: Sed. Trap 1

Inflow Area =	1.200 ac,	Inflow Depth >	1.20"	for 25 Year-24 hrs event
Inflow =	2.07 cfs @	12.07 hrs,	Volume=	0.120 af
Outflow =	1.47 cfs @	12.17 hrs,	Volume=	0.109 af, Atten= 29%, Lag= 5.7 min
Primary =	1.47 cfs @	12.17 hrs,	Volume=	0.109 af
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 256.89' @ 12.17 hrs Surf.Area= 647 sf Storage= 1,017 cf
Plug-Flow detention time= 48.3 min calculated for 0.109 af (91% of inflow)
Center-of-Mass det. time= 18.8 min (852.3 - 833.5)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	2,194 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
255.00	350	0	0
256.00	494	422	422
258.00	836	1,330	1,752
258.50	933	442	2,194

Device	Routing	Invert	Outlet Devices
#1	Primary	256.00'	**Rock Dam**
			Head (feet) 0.00 0.50 1.00 1.50 2.00
			Disch. (cfs) 0.000 0.410 1.750 4.220 8.000
#2	Secondary	258.50'	**143.0 deg x 10.0' long Sharp-Crested Vee/Trap Weir** C= 2.47

Primary OutFlow Max=1.42 cfs @ 12.17 hrs HW=256.88' (Free Discharge)
└─**1=Rock Dam** (Custom Controls 1.42 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.00' (Free Discharge)
└─**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Sediment Basin Analysis

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

DATE 23-May-06
BY KBS
JOB NO Flowers 06-1

LCID Recycling Center
Sediment Basin "A"
Sediment Basin Design

Objective: Establish guidelines for sediment basin design.

Reference:
1. Flowers LCID Recycling plan
2. "Elements of Urban Stormwater Design", H. Rooney Malcom, NCSU
3. NC Erosion and Sediment Control Planning and Design Manual

Calculations: The basins will be designed as follows:

* All permanent sediment basins will be designed to control runoff from the 10 year storm event or better.

> The rational method will be used to determine peak runoff and time of concentration as defined on Page I-3 (Ref. 2).

* A stormwater routing spreadsheet will be used to determine stormwater flows over time as defined by the chainsaw routing procedure on Page III-18 (Ref. 2).

> Inflow to the basin will be based on the small watershed method on Page III-3 (Ref. 2).

* Outflow from the emergency spillway will be calculated according to the weir equation as defined on Page III-10 (Ref. 2).

* Outflow from the principal spillway will be determined by the controlling value of the following situations:
  - Riser acting as a weir
  - Riser acting as an orifice
  - Barrel acting as an orifice

> Outflows for situations involving an orifice will be determined according to the orifice equation as defined on Page III-11 (Ref. 2).

* The stage-storage function will be used to determine principal spillway elevations as defined on Page III-4 (Ref. 2).

* The settling efficiency of the basin will be calculated according to the method defined in Malcolm's "Efficiency Based Design of Stormwater Settling Ponds"

* If basin is in the 100 Year Floodplain, it will be checked for ability to control the 100 Year Storm (High Tailwater Condition).

> For this condition, the minimum outflow from the principal spillway will be used.

> Barrel outflow with high tailwater is determined by an energy balance yielding as follows:

$$Q = \sqrt{\frac{z_A - z_B}{\frac{522}{D^4}\left(\frac{12fL}{D} + K_L\right)}}$$

Where: Q = outflow (cfs)
Z_A = upstream water elevation (ft)
Z_B = downstream water elevation (ft)
D = outlet pipe diameter (in)
L = length of outlet pipe (ft)
KL = loss coefficient

$$f = \frac{425n^2}{D^{0.33}}$$

n = manning's roughness coefficient

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

DATE 23-May-06
BY KBS
JOB NO Flowers 06-1

LCID Recycling Center
Sediment Basin "A"
Sediment Basin Design

Objective: Size basin to handle runoff from the referenced project per delineated drainage areas

Calculations:

1. *Peak Inflow, Q_P and Time to Peak, T_P for 10 Year Storm*

Time of Concentration, t_c

t_c = 5 minutes ----> worst case

-------> Find Peak Inflow, Q_P = CIA

C = 0.35 ----> Pre-Development Conditions, Unimproved Cleared Area, Ref. 2
I = 7.22 in/hr ----> IDF Spreadsheet - 10 Year Storm @ 5.0 minutes (ATTACHMENT B)
A = 10.10 acres ----> Equivalent acres from Sediment Basin Flow Schematic

Q_P = 25.52 cfs

-------> Find Time to Peak, $T_P = (Q^*A)/(1.39*Q)$

where: $Q^* = (P-0.2S)^2/(P+0.8S)$ & $S = (1000/CN) - 10$

CN = 49 ----> Open Spaces - fair condition, Soil Type C (Ref. 3)
P = 5.8 inches ---> DDF Spreadsheet - 10 Year Storm @ 24 hours (ATTACHMENT B)
S = 10.41
Q^* = 0.98 inches
T_P = 16.86 minutes

------> Find Basin Dimensions and Capacities, Ks and b.

Ks = 3413.23
b= 1.28

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

DATE 19-Jun-06
BY KBS
JOB NO Flowers 06-1

✓ PRS

LCID Recycling Center
Sediment Basin "A"
Sediment Basin Design

Objective: Size basin to handle runoff from the referenced project per delineated drainage areas

Calculations:

2. *Determine Basin Dewatering*

Assume hydraulic head is from crest of berm to cleanout elevation.

crest of the Berm = 238'
cleanout Elevation = 233.2'

h_t = 4.8 feet

use equation from Ref. 3

$$A_o = \frac{A_s\sqrt{2h_t}}{T * C_d * 20248}$$

A_s =	0.16	acres ----> from Routing Spreadsheet
h_t =	4.80	feet
T =	10	hours ----> better settling over typical 10 hour time
C_d =	0.6	default -----> typical
A_o =	0.17	ft^2

dia. of hole =	0.75	inch
area of hole =	3.07E-03	ft^2
number of holes required =	57	holes

3. *Determine Anti-flotation Contrete Block*

An anchor for the riser must equal 1.1 times the weight of water displaced by the riser.

Riser diameter =	24	inches
Riser height =	4.00	feet
Volume of air =	12.57	ft^3
Uplift force =	784	pounds

Apply a factor of safety of 1.1

Adjusted Uplift force =	863	pounds
Unit weight of concrete =	150	lbs/ft^3
Volume of concrete required =	10	ft^3
width =	[redacted]	feet
height =	[redacted]	feet
length =	[redacted]	feet
Resulting volume =	**18.0**	ft^3 ✓

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

Date 23-May-06
By KBS
Job# Flowers 06-1

LCID Recycling Center
Sediment Basin "A"
Stage Storage Function

Sediment Basin Sediment Basin "A"

Contour Elevation	Area (square feet)	Volume* (cubic feet)	Storage, S (cubic feet)	Stage Z	lnS	lnZ	Zest** (feet)
231	3,155		0	0.0			0.00
232	3,907	3,531	3,531	1.0	8.1693	0.0000	1.03
234	5,605	9,512	13,043	3.0	9.4760	1.0986	2.84
236	7,585	22,984	26,515	5.0	10.1855	1.6094	4.93
238	9,820	17,405	43,920	7.0	10.6901	1.9459	7.30

Required Volume =	18,180	cubic feet	ks =	#REF!	3413.23
Available Volume =	43,920	cubic feet	b =	~~1.28~~	1.28
Required volume height =	3.68	feet above bottom			
Cleanout height @ 1/2 Volume =	2.14	feet above bottom			

~~SUMMARY OUTPUT~~

Regression Statistics	
~~Multiple R~~	~~0.999812511~~
~~R Square~~	~~0.999626173~~
~~Adjusted R Square~~	~~0.999450346~~
~~Standard Error~~	~~0.03804502~~
~~Observations~~	~~3~~

~~ANOVA~~

	df	*SS*	*MS*	*F*	*Significance F*
~~Regression~~	~~1~~	~~1.01430872~~	~~1.01430872~~	~~1380.610733~~	~~0.017723055~~
~~Residual~~	~~1~~	~~0.000734523~~	~~0.000734523~~		
~~Total~~	~~2~~	~~1.015043243~~			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
~~Intercept~~	~~7.206520539~~	~~0.048526073~~	~~147.8458736~~	~~0.004311738~~	~~6.589441826~~	~~7.823100254~~	~~6.589441826~~	~~7.823100254~~
~~X Variable 1~~	~~1.281882464~~	~~0.035805045~~	~~35.81115063~~	~~0.017723055~~	~~0.828324418~~	~~1.735440509~~	~~0.828324418~~	~~1.735440509~~

Notes:

* Calculated according to Average End Area Method

** Calculated using the Stage-Storage Function as described in "Elements of Urban Stormwater Design" by H.R. Malcolm, P.E.(II-4)

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

DATE 23-May-06
BY KBS

LCID Recycling Center
Sediment Basin "A"
Stormwater Routing

Inflow Hydrograph		Reservoir		Riser		Results	
		Ks =	3413.23	Riser Cd=	0.6	Average Outflow (cfs)=	1.0
Qp (cfs) =	25.5	b =	1.28	Cw=	3.33	Peak Outflow (cfs)=	12.6
Tp (min) =	16.9			Dia.(in)=	24	Maximum Elevation (ft)=	235.71
dt (min) =	4.0	Emergency Spillway		Riser Elev.=	235.0	Maximum Storage (cf)=	25,009
		Cw =	3	Barrel Cd=	0.6	Normal Area (ac)=	0.15
		L (ft) =	12	Barrel Dia =	18	Maximum Area (ac)=	0.16
		Crest Elev.=	236	Bottom Elev.=	231.0	Minimum Efficiency (%)=	74.44

Stormwater Routing*

Time (min)	Inflow (cfs)	Storage (cf)	Elevation (ft)	Riser/Barrel (cfs)	Weir (cfs)	Total Outflow (cfs)	Efficiency %
0	0.0	0	231.00	0.0	0.0	0.0	100.00
4	3.4	0	231.00	0.0	0.0	0.0	100.00
8	11.7	812	231.33	0.0	0.0	0.0	100.00
12	20.6	3,630	232.05	0.0	0.0	0.0	100.00
16	25.4	8,584	233.05	0.0	0.0	0.0	100.00
20	23.4	14,671	234.11	0.0	0.0	0.0	100.00
24	17.4	20,286	235.00	0.0	0.0	0.0	100.00
28	12.8	24,462	235.63	10.5	0.0	10.5	78.66
32	9.4	25,009	235.71	12.6	0.0	12.6	74.44
36	6.9	24,245	235.60	9.7	0.0	9.7	80.36
40	5.1	23,569	235.50	7.4	0.0	7.4	85.68
44	3.7	23,012	235.42	5.6	0.0	5.6	89.89
48	2.7	22,555	235.35	4.3	0.0	4.3	93.06
52	2.0	22,180	235.29	3.3	0.0	3.3	95.34
56	1.5	21,870	235.25	2.5	0.0	2.5	96.92
60	1.1	21,615	235.21	2.0	0.0	2.0	98.00
64	0.8	21,404	235.17	1.5	0.0	1.5	98.71
68	0.6	21,229	235.15	1.2	0.0	1.2	99.17
72	0.4	21,084	235.13	0.9	0.0	0.9	99.47
76	0.3	20,963	235.11	0.7	0.0	0.7	99.66
80	0.2	20,862	235.09	0.6	0.0	0.6	99.78
84	0.2	20,778	235.08	0.5	0.0	0.5	99.86
88	0.1	20,707	235.07	0.4	0.0	0.4	99.91
92	0.1	20,647	235.06	0.3	0.0	0.3	99.94
96	0.1	20,597	235.05	0.2	0.0	0.2	99.96
100	0.0	20,555	235.04	0.2	0.0	0.2	99.97
104	0.0	20,519	235.04	0.2	0.0	0.2	99.98
108	0.0	20,488	235.03	0.1	0.0	0.1	99.99
112	0.0	20,462	235.03	0.1	0.0	0.1	99.99
116	0.0	20,440	235.03	0.1	0.0	0.1	99.99
120	0.0	20,420	235.02	0.1	0.0	0.1	100.00
124	0.0	20,404	235.02	0.1	0.0	0.1	100.00
128	0.0	20,390	235.02	0.1	0.0	0.1	100.00
132	0.0	20,377	235.02	0.0	0.0	0.0	100.00
136	0.0	20,366	235.02	0.0	0.0	0.0	100.00
140	0.0	20,357	235.01	0.0	0.0	0.0	100.00
144	0.0	20,348	235.01	0.0	0.0	0.0	100.00
148	0.0	20,341	235.01	0.0	0.0	0.0	100.00
152	0.0	20,335	235.01	0.0	0.0	0.0	100.00
156	0.0	20,329	235.01	0.0	0.0	0.0	100.00
160	0.0	20,324	235.01	0.0	0.0	0.0	100.00
164	0.0	20,319	235.01	0.0	0.0	0.0	100.00
168	0.0	20,315	235.01	0.0	0.0	0.0	100.00
172	0.0	20,311	235.01	0.0	0.0	0.0	100.00
176	0.0	20,308	235.01	0.0	0.0	0.0	100.00
180	0.0	20,305	235.01	0.0	0.0	0.0	100.00
184	0.0	20,302	235.01	0.0	0.0	0.0	100.00
188	0.0	20,300	235.01	0.0	0.0	0.0	100.00
192	0.0	20,298	235.01	0.0	0.0	0.0	100.00
196	0.0	20,296	235.01	0.0	0.0	0.0	100.00
200	0.0	20,294	235.00	0.0	0.0	0.0	100.00
204	0.0	20,292	235.00	0.0	0.0	0.0	100.00
208	0.0	20,290	235.00	0.0	0.0	0.0	100.00
212	0.0	20,289	235.00	0.0	0.0	0.0	100.00
216	0.0	20,288	235.00	0.0	0.0	0.0	100.00
220	0.0	20,286	235.00	0.0	0.0	0.0	100.00
224	0.0	20,285	235.00	0.0	0.0	0.0	100.00
228	0.0	20,284	235.00	0.0	0.0	0.0	100.00
232	0.0	20,283	235.00	0.0	0.0	0.0	100.00
236	0.0	20,282	235.00	0.0	0.0	0.0	100.00
240	0.0	20,281	235.00	0.0	0.0	0.0	100.00
244	0.0	20,280	235.00	0.0	0.0	0.0	100.00
248	0.0	20,280	235.00	0.0	0.0	0.0	100.00

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

DATE 23-May-08
BY KBS
JOB NO: Flowers 06-1

Flowers LCID Recycling Facility
Sediment Basin "B"
Sediment Basin Design

Objective: Establish guidelines for sediment basin design.

Reference:
1. Flowers LCID Recycling plan
2. "Elements of Urban Stormwater Design", H. Rooney Malcom, NCSU
3. NC Erosion and Sediment Control Planning and Design Manual

Calculations: The basins will be designed as follows:

* All permanent sediment basins will be designed to control runoff from the 10 year storm event or better.

> The rational method will be used to determine peak runoff and time of concentration as defined on Page I-3 (Ref. 2).

* A stormwater routing spreadsheet will be used to determine stormwater flows over time as defined by the chainsaw routing procedure on Page III-18 (Ref. 2).

> Inflow to the basin will be based on the small watershed method on Page III-3 (Ref. 2).

* Outflow from the emergency spillway will be calculated according to the weir equation as defined on Page III-10 (Ref. 2).

* Outflow from the principal spillway will be determined by the controlling value of the following situations:
  - Riser acting as a weir
  - Riser acting as an orifice
  - Barrel acting as an orifice

> Outflows for situations involving an orifice will be determined according to the orifice equation as defined on Page III-11 (Ref. 2).

* The stage-storage function will be used to determine principal spillway elevations as defined on Page III-4 (Ref. 2).

* The settling efficiency of the basin will be calculated according to the method defined in Malcolm's "Efficiency Based Design of Stormwater Settling Ponds"

* If basin is in the 100 Year Floodplain, it will be checked for ability to control the 100 Year Storm (High Tailwater Condition).

> For this condition, the minimum outflow from the principal spillway will be used.

> Barrel outflow with high tailwater is determined by an energy balance yielding as follows:

$$Q = \sqrt{\frac{z_A - z_B}{\frac{522}{D^4}\left(\frac{12fL}{D} + KL\right)}}$$

Where: Q = outflow (cfs)
Z_A = upstream water elevation (ft)
Z_B = downstream water elevation (ft)
D = outlet pipe diameter (in)
L = length of outlet pipe (ft)
KL = loss coefficient

$$f = \frac{425n^2}{D^{0.33}}$$

n = manning's roughness coefficient

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

DATE 23-May-06
BY KBS
JOB NO Flowers 06-1

Flowers LCID Recycling Facility
Sediment Basin "B"
Sediment Basin Design

Objective: Size basin to handle runoff from the referenced project per delineated drainage areas

Calculations:

1. *Peak Inflow, Q_P and Time to Peak, T_P for 10 Year Storm*

Time of Concentration, t_c

t_c = 5 minutes ----> worst case

-------> Find Peak Inflow, Q_P = CIA

C = 0.35 ----> Pre-Development Conditions, Unimproved Cleared Area, Ref. 2
I = 7.22 in/hr ----> fDF Spreadsheet - 10 Year Storm @ 5.0 minutes (ATTACHMENT B)
A = 4.80 acres ----> Equivalent acres from Sediment Basin Flow Schematic

Q_P = 12.13 cfs

-------> Find Time to Peak, $T_P = (Q^*A)/(1.39*Q)$

where: $Q^* = (P-0.2S)^2/(P+0.8S)$ & $S = (1000/CN) - 10$

CN = 49 ----> Open Spaces - fair condition, Soil Type C (Ref. 3)
P = 5.8 inches ---> DDF Spreadsheet - 10 Year Storm @ 24 hours (ATTACHMENT B)
S = 10.41
Q^* = 0.98 inches
T_P = 16.86 minutes

-------> Find Basin Dimensions and Capacities, Ks and b.

See Stage Storage Spreadsheet

Ks = 2098.82
b= 1.46

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

DATE 19-Jun-06
BY KBS
JOB NO Flowers 06-1

✓ PLS

Flowers LCID Recycling Facility
Sediment Basin "B"
Sediment Basin Design

Objective: Size basin to handle runoff from the referenced project per delineated drainage areas

Calculations:

2. *Determine Basin Dewatering*

Assume hydraulic head is from crest of berm to cleanout elevation.

crest of Berm = 246'
Cleanout Elevation = 242.2'

h_t = 3.8 feet

use equation from Ref. 3

$$A_o = \frac{A_s\sqrt{2h_t}}{T * C_d * 20248}$$

A_s =	0.13	acres ----> from Routing Spreadsheet
h_t =	3.80	feet
T =	10	hours ----> better settling over typical 10 hour time
C_d =	0.6	default ----> typical
A_o =	0.13	ft^2

dia. of hole = 0.75 inch
area of hole = 3.07E-03 ft^2

number of holes required = 43 holes

3. *Determine Anti-flotation Contrete Block*

An anchor for the riser must equal 1.1 times the weight of water displaced by the riser.

Riser diameter =	24	inches
Riser height =	4.00	feet
Volume of air =	12.57	ft^3
Uplift force =	784	pounds

Apply a factor of safety of 1.1

Adjusted Uplift force =	863	pounds
Unit weight of concrete =	150	lbs/ft^3
Volume of concrete required =	10	ft^3
width =	[redacted]	feet
height =	[redacted]	feet
length =	[redacted]	feet
Resulting volume =	**18.0**	ft^3 ✓

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

Date 23-May-08
By KBS
Job# Flowers 06-1

Flowers LCID Recycling Facility
Sediment Basin "B"
Stage Storage Function

Contour Elevation	Area (square feet)	Volume* (cubic feet)	Storage, S (cubic feet)	Stage Z	lnS	lnZ	Zest** (feet)
240	2,300		0	0.0			0.00
242	3,600	5,900	5,900	2.0	8.6827	0.6931	2.03
244	5,450	9,050	14,950	4.0	9.6125	1.3863	3.84
246	8,340	23,880	29,780	6.0	10.3016	1.7918	6.16

Required Volume =	8,640	cubic feet	ks =	#REF!	2098.82
Available Volume =	23,880	cubic feet	b =	1.28	1.46
Required volume height =	2.64	feet above bottom			
Cleanout height @ 1/2 Volume =	1.64	feet above bottom			

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999812511
R Square	0.999625173
Adjusted R Square	0.999450348
Standard Error	0.02804602
Observations	3

ANOVA

	df	SS	MS	F	Significance F
Regression	1	1.01439873	1.01439873	1289.810733	0.017723055
Residual	1	0.000786629	0.000786629		
Total	2	1.015005243			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	7.208820530	0.048626073	147.6458736	0.004311736	6.588441825	7.829199264	6.588441825	7.829199264
X Variable 1	1.361882484	0.037895945	35.91116052	0.017723055	0.878924418	1.736440500	0.878924418	1.736440500

Notes:

* Calculated according to Average End Area Method

** Calculated using the Stage-Storage Function as described in "Elements of Urban Stormwater Design" by H.R. Malcolm, P.E.(III-4)

G.N. Richardson & Associates, Inc.
ENGINEERING AND GEOLOGICAL SERVICES

DATE: 23-May-06
BY: KBS

Flowers LCID Recycling Facility
Sediment Basin "B"
Stormwater Routing

Inflow Hydrograph		Reservoir		Riser		Results	
		Ks =	2098.82	Riser Co=	0.6	Average Outflow (cfs)=	0.2
Qp (cfs) =	12.1	b =	1.46	Cw=	3.33	Peak Outflow (cfs)=	0.6
Tp (min) =	16.9			Dia.(in)=	24	Maximum Elevation (ft)=	244.09
dt (min) =	2.0	Emergency Spillway		Riser Elev.=	244.0	Maximum Storage (cf)=	16,403
		Cw =	3	Barrel Cd=	0.6	Normal Area (ac)=	0.13
		L (ft) =	12	Barrel Dia.=	18	Maximum Area (ac)=	0.13
		Crest Elev.=	245	Bottom Elev.=	240.0	Minimum Efficiency (%)=	99.73

Stormwater Routing*

Time (min)	Inflow (cfs)	Storage (cf)	Elevation (ft)	Riser/Barrel (cfs)	Weir (cfs)	Total Outflow (cfs)	Efficiency %
0	0.0	0	240.00	0.0	0.0	0.0	100.00
2	0.4	0	240.00	0.0	0.0	0.0	100.00
4	1.6	50	240.08	0.0	0.0	0.0	100.00
6	3.4	243	240.23	0.0	0.0	0.0	100.00
8	5.6	652	240.45	0.0	0.0	0.0	100.00
10	7.8	1,322	240.73	0.0	0.0	0.0	100.00
12	9.8	2,260	241.05	0.0	0.0	0.0	100.00
14	11.3	3,437	241.40	0.0	0.0	0.0	100.00
16	12.1	4,792	241.76	0.0	0.0	0.0	100.00
18	12.0	6,238	242.11	0.0	0.0	0.0	100.00
20	11.1	7,677	242.43	0.0	0.0	0.0	100.00
22	9.7	9,012	242.71	0.0	0.0	0.0	100.00
24	8.3	10,170	242.95	0.0	0.0	0.0	100.00
26	7.1	11,162	243.14	0.0	0.0	0.0	100.00
28	6.1	12,013	243.31	0.0	0.0	0.0	100.00
30	5.2	12,742	243.44	0.0	0.0	0.0	100.00
32	4.5	13,367	243.56	0.0	0.0	0.0	100.00
34	3.8	13,902	243.65	0.0	0.0	0.0	100.00
36	3.3	14,361	243.74	0.0	0.0	0.0	100.00
38	2.8	14,755	243.81	0.0	0.0	0.0	100.00
40	2.4	15,092	243.86	0.0	0.0	0.0	100.00
42	2.1	15,381	243.92	0.0	0.0	0.0	100.00
44	1.8	15,629	243.96	0.0	0.0	0.0	100.00
46	1.5	15,841	243.99	0.0	0.0	0.0	100.00
48	1.3	16,023	244.03	0.1	0.0	0.1	99.99
50	1.1	16,168	244.05	0.2	0.0	0.2	99.95
52	1.0	16,273	244.07	0.4	0.0	0.4	99.88
54	0.8	16,341	244.08	0.5	0.0	0.5	99.81
56	0.7	16,382	244.09	0.5	0.0	0.5	99.76
58	0.6	16,400	244.09	0.6	0.0	0.6	99.73
60	0.5	16,403	244.09	0.6	0.0	0.6	99.73
62	0.4	16,396	244.09	0.6	0.0	0.6	99.74
64	0.4	16,381	244.09	0.5	0.0	0.5	99.76
66	0.3	16,361	244.08	0.5	0.0	0.5	99.79
68	0.3	16,338	244.08	0.5	0.0	0.5	99.81
70	0.2	16,314	244.08	0.4	0.0	0.4	99.84
72	0.2	16,290	244.07	0.4	0.0	0.4	99.86
74	0.2	16,266	244.07	0.4	0.0	0.4	99.88
76	0.1	16,242	244.06	0.3	0.0	0.3	99.90
78	0.1	16,219	244.06	0.3	0.0	0.3	99.92
80	0.1	16,198	244.06	0.3	0.0	0.3	99.93
82	0.1	16,177	244.05	0.3	0.0	0.3	99.94
84	0.1	16,158	244.05	0.2	0.0	0.2	99.95
86	0.1	16,140	244.05	0.2	0.0	0.2	99.96
88	0.1	16,123	244.04	0.2	0.0	0.2	99.97
90	0.1	16,108	244.04	0.2	0.0	0.2	99.97
92	0.0	16,093	244.04	0.2	0.0	0.2	99.98
94	0.0	16,079	244.04	0.1	0.0	0.1	99.98
96	0.0	16,067	244.03	0.1	0.0	0.1	99.98
98	0.0	16,055	244.03	0.1	0.0	0.1	99.99
100	0.0	16,044	244.03	0.1	0.0	0.1	99.99
102	0.0	16,034	244.03	0.1	0.0	0.1	99.99
104	0.0	16,024	244.03	0.1	0.0	0.1	99.99
106	0.0	16,015	244.03	0.1	0.0	0.1	99.99
108	0.0	16,007	244.02	0.1	0.0	0.1	99.99
110	0.0	16,000	244.02	0.1	0.0	0.1	100.00
112	0.0	15,993	244.02	0.1	0.0	0.1	100.00
114	0.0	15,986	244.02	0.1	0.0	0.1	100.00
116	0.0	15,980	244.02	0.1	0.0	0.1	100.00
118	0.0	15,974	244.02	0.1	0.0	0.1	100.00
120	0.0	15,969	244.02	0.0	0.0	0.0	100.00
122	0.0	15,964	244.02	0.0	0.0	0.0	100.00
124	0.0	15,959	244.02	0.0	0.0	0.0	100.00

Sediment Trap Analysis

G.N. Richardson & Associates
Engineering and Geological Services
14 N. Boylan Avenue Tel: 919-828-0577
Raleigh, NC 27603 Fax: 919-828-3899

SHEET 1
JOB # Flowers 08-1
DATE 5/23/00
BY KBS
CHKD BY RKS

Flowers LCID Recycling Center
Sediment Trap/Rock Dam Analysis

Trap/Rock Dam No.: ST-1

DESIGN FOR WET (IF APPLICABLE) AND DRY STORAGE: (For 10-Yr, 24 Hr. Storm)

Areas Draining Into Basin:

Drainage Area	Area (acres)
A5	1.2
Total =	1.2 Acres

Basin Requirements:

Wet Storage

Required Storage Capacity (ft^3/Ac.) =	0	Enter "0" If Not Applicable.
Required Storage Capacity (ft^3) =	0	
Required Depth of Wet Storage (ft) =	1.5	Enter "0" If Not Applicable.

Dry Storage:

Required Storage Capacity (ft^3/Ac.) =	1,800	To Measurement Elevation
Required Storage Capacity (ft^3) =	2,160	
Multiplier (X) for Desired Surface Area (Qp x X) =	0.01	At Measurement Elevation
Peak Discharge into Basin (Qp) (cfs) =	1.4	From HydroCAD - 10-Yr, 24-Hr. Storm
Desired Surface Area (Ac) =	0.01	
Desired Surface Area (ft^2) =	588	

SIZE BASIN:

Rectangular Basin - Initial Sizing (If Used):

Depth or Height (ft) =	3.5	Bottom of Basin to Measurement Elevation
Length:Width Ratio =	2	(Min. = 2)
Side Slope Ratio =	2	(Max. = 2)

Length of Basin @ Measurement Elev. (ft) =	50	(Iterate)	Volume Reqd. (ft^3) =	2,160
Width of Basin @ Measurement Elev. (ft) =	25		Volume Actual (ft^3) =	2,861 O.K.
Length of Basin @ Base (ft) =	36		Surface Area Reqd. (ft^2) =	588
Width of Basin @ Base (ft) =	11		Surface Area Actual (ft^2) =	1,250 O.K.

SHEET	1
JOB #	Flowers 06-1
DATE	5/23/06
BY	KBS
CHKD BY	PKS

Custom Size - or Refined Rectangular Basin:

Determine Stage-Storage Function:

Contour	Area (ft^2)	Area (acres)	Incremental Volume (ft^3)	Cumulative Volume (ft^3)	Stage (ft)	ln S	ln Z	Z est
255	350	0.008		0	0			
256	494	0.011	422	422	1	6.05	0.00	1.00
258	830	0.019	1,330	1,752	3	7.47	1.10	3.00
258.5	933	0.021	442	2,194	3.5	7.69	1.25	3.50

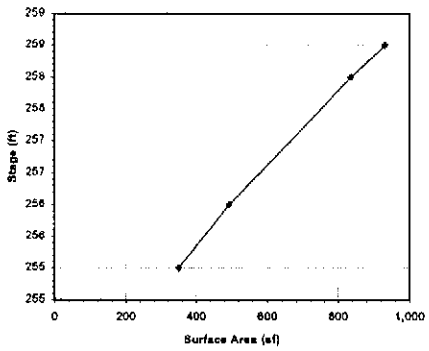
Linear Regression Constants:

Ks = 421 Storage = 421 z^1.31

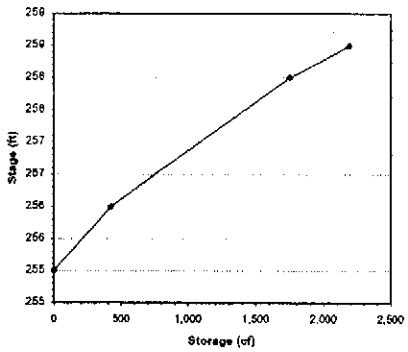
b = 1.31

*CAUTION: CHECK INPUT FOR REGRESSION ANALYSIS!

Stage-Surface Area Relationship



Stage-Storage Relationship



Basin Design Elevations: *Based on Custom Size

Elev. of Bottom of Basin =	255.0	

Wet Storage:

Required Storage Capacity (ft^3) =	0	
Min. Elev. of Wet Storage (Permanent Pool) =	256.5	
Selected Elev. of Wet Storage (Permanent Pool) =	256.5	O.K.
Actual Wet Storage Volume (ft^3) =	716	O.K.

Dry Storage:

Required Storage Capacity (ft^3) =	**2,876**	**= Required Dry Storage + Actual Wet Storage**
Min. Measurement Elev. =	**259.3**	
Selected Measurement Elev. =	**256.5**	**No Good. Below Required Elevation.**
Actual Total Storage Volume (ft^3) =	2,170	No Good.
Desired Surface Area (ft^2) =	588	
Actual Surface Area at Spillway (Weir) (ft^2) =	811	O.K.

Cleanout:

Cleanout Requirement (% of Wet Storage) =	0	Enter "0" If Not Applicable
Cleanout Requirement (% of Total Storage) =	50	
Basin Cleanout Volume (ft^3) =	1,085	Based on 50% of Total Storage Volume
Basin Cleanout Elevation =	257.1	

Spillway (Weir) Elev.:

Spillway (Weir) Elev. - Measurement Elev. (ft) =	0	Enter "0" If Measurement Elevation is at Weir
Spillway (Weir) Elevation =	256.5	

SHEET:	1
JOB #:	Flowers 06-1
DATE:	5/23/06
BY:	KBS
CHKD BY:	PKS

Basin Shape:

Length of Basin (ft) =	50.0	**Measured at Crest of Weir**
Width of Basin (ft) =	25.0	**Measured at Crest of Weir**
Desired Length to Width Ratio (X:1) =	2	
Actual Length to Width Ratio (X:1) =	2	O.K.

SPILLWAY CALCULATIONS:

Crest Elev. (ft) =	258.5	
Required Freeboard (ft) =	1.5	
Top of Berm Elev. (ft) =	260.0	
Required Capacity (cfs) =	1.0	From HydroCAD - 10-Yr. 24-Hr. Storm
Driving Head (ft) =	0.5	
Weir Coefficient =	3.0	
Length of Crest (ft) =	1.8	Determine by Weir Equation
Design Crest Length (ft) =	10	

SUMMARY DATA:

Trap/Rock Dam No.: ST-1

Elev. of Bottom of Basin =	255.0
Cleanout Elev. (ft) =	257.1
Elev. of Wet Storage (Permanent Pool) =	256.5
Elev. of Spillway (Weir) =	258.5
Top of Berm Elev. (ft) =	260.0
Top of Berm Width (ft) =	5

G.N. Richardson & Associates
Engineering and Geological Services
14 N. Boylan Avenue Tel: 919-828-0577
Raleigh, NC 27603 Fax: 919-828-3899

SHEET: 1
JOB #. Flowers 06-1
DATE. 5/23/06
BY. KBS
CHKD BY: RKS

Flowers LCID Recycling Center
Sediment Trap/Rock Dam Analysis - Filter Flow

Filter Flow (For Use in HydroCAD):

Permeability of Stone (k) (ft/sec) =	0.50	(Approx. Half of typical permeability of No. 57 Stone to account for clogging)
Base of Stone Elevation (ft) =	256.5	
Length of Stone at Base (ft) =	6	
Crest Elevation (ft) =	258.5	
Length of Stone at Crest (ft) =	10	

Elevation (ft)	Avg. Gradient (ft/ft)	Top Length of Stone (ft^3)	Area of Stone (ft^3)	Filter Flow (cfs)
256.50	0.00	6.00	0.00	0.00
257.00	0.25	7.00	3.25	0.41
257.50	0.50	8.00	7.00	1.75
258.00	0.75	9.00	11.25	4.22
258.50	1.00	10.00	16.00	8.00

Notes: Gradient = Average Head
Filter Flow is based on Darcy's Law (Flow = kiA)

Drainage Channel Analysis

PROJECT Flowers LCID Recycling Center

SUBJECT Drainage Channel Analysis

SHEET 1 OF 10
JOB NO. Flowers 06-1
DATE 6/20/06
COMPUTED BY KBS
CHECKED BY PKS

Objective

To design drainage channels, ditches, etc. to handle stormwater flow from the design storm(s). The main design criteria will be to ensure that all drainage channels, ditches, etc. will be able to accommodate the peak discharge from the design storm without overtopping and without exceeding the allowable shear stress and/or velocity of the selected channel lining.

References

Federal Highway Administration (2001), Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22, FHWA NHI-01-021, Second Ed., U.S. Dept. of Transportation, Washington, D.C.

North Carolina Division of Land Resources (1988 & 1993 Update), North Carolina Erosion & Sediment Control Planning & Design Manual, Raleigh, NC.

Malcom, H. Rooney (1989 & 2003 Supplement), Elements of Urban Stormwater Design, NC State Univ., Raleigh, NC.

Pennsylvania DEP Bureau of Watershed Protection (2000), Erosion and Sediment Pollution Control Program Manual.

Analysis

The following approach is used in the design of drainage channels:

1. Determine the peak discharge from the design storm(s) (from HydroCAD or spreadsheet methods). For permanent linings (Grass, TRM, rip rap, gabions, etc.) use the peak discharge from the 25-Yr 24-Hr storm unless otherwise specified. For grass lined channels, a smaller design storm (2-Yr 24-Hr - unless otherwise specified) is used to evaluate temporary linings.
2. Input other design parameters (bottom width; side slopes; minimum freeboard, min./max. slopes; and channel lining).
3. Based on the design parameters calculate normal depth of flow, velocity, Froude number, and maximum shear stress for both max./min. slopes. Also determine the critical slope and corresponding normal depth.
4. Compare the velocity and/or shear stress to allowable values (the maximum slope values will control). If values are exceeded, revise design parameters as required.
5. Based on normal depth values and required freeboard (generally use the greater of 6 inches or 25% of the flow depth), determine the minimum channel depth and top width for both max./min. slopes (the minimum slope values will control).
6. If the channel has a significant curved reach, evaluate the shear stress and superelevation of the water surface in the bend.

DRAINAGE CHANNEL.WPD

G.N. RICHARDSON & ASSOCIATES
Engineering and Geological Services
14 N. Boylan Avenue, Raleigh, NC 27603
Telephone: (919) 828-0577

Calculations

- Manning's Equation:

$$Q = \frac{1.49 A R^{2/3} S^{1/2}}{n} = AV \qquad \text{(HEC-22 Eq. 5-5)}$$

where:
- Q = discharge (cfs)
- n = Manning's roughness coefficient (See Below)
- A = cross sectional area of flow (ft^2)
- R = hydraulic radius (ft) = A/P
- P = wetted perimeter
- S = slope of channel (ft/ft)
- V = average channel velocity (ft/sec)

- Maximum Shear Stress (Tractive Force Method):

$$\tau_d = \gamma d S \qquad \text{(HEC-22 Eq. 5-13)}$$

where:
- τ_d = maximum shear stress on channel lining (lb/ft^2)
- γ = unit weight of water (62.4 lb/ft^3)
- d = maximum depth of flow (ft)
- S = channel slope (ft/ft)

- Froude Number:

$$Fr = \frac{v}{\sqrt{\frac{gA}{T}}}$$

where:
- Fr = Froude number (dimensionless)
- v = flow velocity (ft/sec)
- g = acceleration of gravity (32.2 ft/sec^2)
- A = cross-sectional area of flow (ft^2)
- T = top width of flow (ft)

Note that A/T = the hydraulic depth (D). For $Fr > 1.0$, flow is supercritical; $Fr < 1.0$, flow is subcritical; $Fr = 1.0$, flow is critical.

Critical Slope:

The critical slope (S_c) is the slope at which $Fr = 1.0$. When the slope is between $0.7S_c$ and $1.3S_c$, unstable flow may occur as small flow disturbances can initiate a change in the flow state. If slopes are within this range, consider additional freeboard.

- Manning's Roughness Coefficient (n):

Grass:

$$n = \frac{R^{1/6}}{\left[K + 19.97\log\left(R^{1.4}S^{0.4}\right)\right]}$$ (HEC-22 Eq. 5-6 - 5-10)

where:
R = hydraulic radius (ft)
K = vegetative coefficient (depending on retardance class)
= 15.8 (Class A)
= 23.0 (Class B)
= 30.2 (Class C)
= 34.6 (Class D)
= 37.7 (Class E)
S = slope of channel (ft/ft)

Rip Rap:

$$n = \frac{y^{1/6}}{21.6\log\left(\frac{y}{d_{50}}\right) + 14}$$ (PA DEP Manual Fig. 3)

where:
y = depth of flow (ft)
d_{50} = median size of rip rap (ft)

- Curved Channels (Where Applicable):

Shear Stress in Bend:

$$\tau_b = K_b \tau_d \qquad \text{(HEC-22 Eq. 5-15)}$$

where:
- τ_d = bend shear stress (lb/ft^2)
- K_b = function of R_c/B (use HEC-22 Chart 21)
- τ_d = maximum shear stress on channel lining (lb/ft^2)
- R_c = radius to the centerline of the channel (ft)
- B = bottom width of channel (ft)

Superelevation at Outside of Bend:

$$\Delta d = 0.5\frac{V^2 T}{gR_c} \qquad \text{(HEC-22 Eq. 5-11 modified)}$$

where:
- Δd = superelevation of water surface between the outer channel bank and the centerline of the channel (avg. water surface before bend) (ft)
- V = average channel velocity (ft/sec)
- T = top width of flow (ft)
- g = acceleration of gravity (32.2 ft/sec^2)
- R_c = radius to the centerline of the channel (ft)

- Allowable Shear Stress/Velocity:

Grass-Lined Channels:

For grass-lined channels, an allowable velocity approach is applicable for slopes flatter than 10%. For slopes of 10% and steeper appropriate permanent linings should be used. For use in the evaluation of curved channels, the following allowable shear stress values (lb/ft^2) can be assumed based on retardance class:

Class A: 3.70
Class B: 2.10
Class C: 1.00
Class D: 0.60
Class E: 0.35

Rip Rap-Lined Channels:

For rip rap-lined channels, an allowable velocity approach is applicable for slopes flatter than 10% (see attached table). For slopes of 10% or steeper, use the following equation:

$$\tau_{allow} = 4 \times d_{50} \qquad \text{(HEC-22 Eq. 5-17)}$$

where: τ_{allow} = allowable shear stress (lb/ft^2)
d_{50} = median size of rip rap (ft)

Reno Mattress or Gabion-Lined Channels:

For Reno mattress or gabion-lined channels, use allowable velocity for slopes flatter than 10% and allowable shear stress for slopes of 10% or steeper (see attached table).

Riprap Gradation, Filter Blanket Requirements, Maximum Velocities

	Graded Rock Size (in)			Filter Blanket Requirements**		
NSA No.	Max.	d_{50}*	Min.	Size NSA No.	Placement Thickness	V_{max} (ft/sec
R-1	1.5	.75	No. 8	FS-1	N/A	2.5
R-2	3	1.5	1	FS-1	N/A	4.5
R-3	6	3	2	FS-1	3	6.5
R-4	12	6	3	FS-2	4	9.0
R-5	18	9	5	FS-2	6	11.5
R-6	24	12	7	FS-3	8	13.0
R-7	30	15	12	FS-3	10	14.5

* The d_{50} stone size is the size exceeded by 50% of the total weight of the tonnage shipped (i.e. 50% by weight shall consist of pieces larger than the d_{50} stone size").

** This is a general standard. Soil conditions at each site should be analyzed to determine actual filter size. A suitable woven or non-woven geotextile underlayment, used according to manufacturer's recommendations, may be substituted for the filter stone.

Ref: PA DEP Manual Table 9

Maximum Permissible Velocities for Reno Mattress & Gabions

Type	n	Thickness Inches	Rock Fill Gradation (in)	Permissible* Velocity (fps)	Permissible** Shear Stress (lb/ft^2)
Reno Mattress	.025 - .030	6	3 - 6	6.0	6.35
	.025 - .030	6 - 10	3 - 6	12.0	6.35
	.026 - .030	10 - 12	3 - 6	15.0	6.35
	.035 - .050	12 - 18	4 - 8	18.0	6.35
Gabion	.027	>18	5 - 9	22.0	6.35

* Permissible velocities may be increased by the introduction of sand mastic grout. Refer to manufacturer's recommendations/specifications for permissible velocities and for recommendations regarding filters or geotextile fabric underlayment when using Reno mattresses or gabions for channel linings.
**Based on vegetation completely grown.

Ref: PA DEP Manual Table 13

G.N. Richardson & Associates
[redacted]
14 N. Boylan Avenue Tel: 919-828-0577
Raleigh, NC 27603 Fax 919-828-3899

SHEET: 6 of 12
JOB #: Flowers 06-1
DATE: 6/20/06
BY: KBS
CHKD BY: PKS

Flowers LCID Recycling Center
Drainage Channel Analysis (Grass Lined)

Channel No. DC-1

Design Parameters:

PEAK DISCHARGE, Q2 = 0.3 ft³/s Source: HydroCAD 2-Yr 24-Hr
PEAK DISCHARGE, Q25 = 7.4 ft³/s Source: HydroCAD 25-Yr 24-Hr

Bottom Width, B = 4.0 ft
Left Side Slope, z_1 = 3.0 horizontal :1 vertical
Right Side Slope, z_2 = 3.0 horizontal :1 vertical
Minimum Freeboard = 0.5 ft

Maximum Channel Slope, S_{max} = 0.050 ft/ft
Minimum Channel Slope, S_{min} = 0.015 ft/ft

Permanent Grass Lining:
Grass Retardance = D
K = 34.6
V_{allow} = 4.5 ft/sec
τ_{allow} = 0.60 lb/ft²

Temporary Lining: NONE
RECP Product Name = ~~NA Green - Curlex I or equal~~
Manning's Coefficient, n = 0.025
τ_{allow} = ~~1.55~~ lb/ft²

≤ 2 ft/sec → OK

Normal Depth

Depth of Flow (Norm. Depth) Y_n ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Average Velocity V_n ft/s	Flow Rate Q ft³/s	Froude Number F_r (Normal) #	Maximum Shear Stress τ_d lb/ft²	Allowable Velocity (V) or Sh. Stress (S) Used?	Factor of Safety V_{allow}/V_n or τ_{allow}/τ_d	Comment
Q2													
Maximum Slope:													
0.05	0.025	0.21	4.32	0.05	4.30	0.05	1.76	0.4	1.41	0.2	S	9.9	O.K.
Minimum Slope:													
0.06	0.025	0.25	4.38	0.06	4.36	0.06	1.08	0.3	0.80	0.1	S	27.6	O.K.
Q25													
Maximum Slope:													
0.51	0.067	2.82	7.23	0.39	7.06	0.40	2.64	7.5	0.74	1.6	V	2.8	O.K.
Minimum Slope:													
0.74	0.073	4.60	8.68	0.53	8.44	0.55	1.63	7.5	0.39	0.7	V	6.5	O.K.

Critical Depth

Depth of Flow (Crit. Depth) Y_c ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Section Factor $Z=AD^{1/2}$ ft^2.5	Flow Rate Q ft³/s	Average Velocity V_c ft/s	Froude Number F_r (Critical) #	Uniform-Flow Critical Slope S_c ft/ft	Comment
Q2												
0.06	0.025	0.25	4.38	0.06	4.36	0.06	0.06	0.3	1.36	1.00	0.024	Slopes Near Sc - Check Freeboard.
Q25												
0.42	0.076	2.21	6.66	0.33	6.52	0.34	1.29	7.3	3.30	1.00	0.124	Flow is Stable.

Determination of Minimum Channel Depth & Top Width (Based on Q25)

Maximum Slope		Minimum Slope	
Minimum Channel Depth ft	Minimum Top Width T ft	Minimum Channel Depth ft	Minimum Top Width T ft
1.01	10.06	**1.24**	**11.44**

✓ check

G.N. Richardson & Associates
14 N. Boylan Avenue Tel: 919-828-0577
Raleigh, NC 27603 Fax: 919-828-3899

SHEET: 7 of 10
JOB #: Flowers 06-1
DATE: 6/20/06
BY: KBS
CHKD BY: PKS

Flowers LCID Recycling Center
Drainage Channel Analysis (Grass Lined)

Channel No. DC-2

Design Parameters:

PEAK DISCHARGE, Q2 = 0.3 ft³/s Source: HydroCAD 2-Yr 24-Hr
PEAK DISCHARGE, Q25 = 6.4 ft³/s Source: HydroCAD 25-Yr 24-Hr

Bottom Width, B = 4.0 ft
Left Side Slope, z_1 = 3.0 horizontal :1 vertical
Right Side Slope, z_2 = 3.0 horizontal :1 vertical
Minimum Freeboard = 0.5 ft

Maximum Channel Slope, S_{max} = 0.075 ft/ft
Minimum Channel Slope, S_{min} = 0.015 ft/ft

Permanent Grass Lining:
Grass Retardance = D
K = 34.6
V_{allow} = 4.5 ft/sec
τ_{allow} = 0.60 lb/ft²

Temporary Lining: NONE
RECP Product Name = ~~NA Green - Conex I, or equal~~
Manning's Coefficient, n = 0.025
τ_{allow} = ~~1.55~~ lb/ft²

≤ 2 O.K.

Normal Depth

Depth of Flow (Norm. Depth) Y_n ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Average Velocity V_n ft/s	Flow Rate Q ft³/s	Froude Number F_r (Normal) #	Maximum Shear Stress τ_d lb/ft²	Allowable Velocity (V) or Sh. Stress (S) Used?	Factor of Safety V_{allow}/V_n or τ_{allow}/τ_d	Comment
Q2													
Maximum Slope:													
0.04	0.025	0.16	4.25	0.04	4.24	0.04	1.87	0.3	1.67	**0.2**	S	8.3	O.K.
Minimum Slope:													
0.06	0.025	0.25	4.38	0.06	4.36	0.06	1.08	0.3	0.80	**0.1**	S	27.6	O.K.
Q25													
Maximum Slope:													
0.42	0.068	2.21	6.66	0.33	6.52	0.34	2.90	6.4	0.88	**2.0**	V	2.3	O.K.
Minimum Slope:													
0.70	0.076	4.27	8.43	0.51	8.20	0.52	1.52	6.5	0.37	**0.7**	V	6.9	O.K.

Critical Depth

Depth of Flow (Crit. Depth) Y_c ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Section Factor $Z=AD^{1/2}$ ft^2.5	Flow Rate Q ft³/s	Average Velocity V_c ft/s	Froude Number F_r (Critical) #	Uniform-Flow Critical Slope S_c ft/ft	Comment
Q2												
0.05	0.025	0.21	4.32	0.05	4.30	0.05	0.05	0.3	1.25	1.00	0.025	Slopes Near Sc - Check Freeboard.
Q25												
0.39	0.073	2.02	6.47	0.31	6.34	0.32	1.14	6.5	3.20	1.00	0.115	Flow is Stable.

check

Determination of Minimum Channel Depth & Top Width (Based on Q25)

Maximum Slope		Minimum Slope	
Minimum Channel Depth ft	Minimum Top Width T ft	Minimum Channel Depth ft	Minimum Top Width T ft
0.92	9.52	1.20	11.20

G.N. Richardson & Associates
[redacted]
14 N. Boylan Avenue Tel: 919-828-0577
Raleigh, NC 27603 Fax: 919-828-3899

SHEET: 8 /10
JOB #: Flowers 06-1
DATE: 6/20/06
BY: KBS
CHKD BY: PKS

Flowers LCID Recycling Center
Drainage Channel Analysis (Grass Lined)

Channel No. DC-3

Design Parameters:

PEAK DISCHARGE, Q2 = 0.2 ft³/s Source: HydroCAD 2-Yr 24-Hr
PEAK DISCHARGE, Q25 = 5.6 ft³/s Source: HydroCAD 25-Yr 24-Hr

Bottom Width, B = 4.0 ft
Left Side Slope, z_1 = 3.0 horizontal :1 vertical
Right Side Slope, z_2 = 3.0 horizontal :1 vertical
Minimum Freeboard = 0.5 ft

Maximum Channel Slope, S_{max} = 0.160 ft/ft
Minimum Channel Slope, S_{min} = 0.015 ft/ft

Permanent Grass Lining:
Grass Retardance = D
K = 34.6
V_{allow} = 4.5 ft/sec
τ_{allow} = 0.60 lb/ft²

Temporary Lining: NONE
RECP Product Name = ~~NA Green Gerker I, or equal~~
Manning's Coefficient, n = 0.025
τ_{allow} = ~~1.55~~ lb/ft²

≤ 2 O.K.

Normal Depth

Depth of Flow (Norm. Depth) Y_n ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Average Velocity V_n ft/s	Flow Rate Q ft³/s	Froude Number F_r (Normal) #	Maximum Shear Stress τ_d lb/ft²	Allowable Velocity (V) or Sh. Stress (S) Used?	Factor of Safety V_{allow}/V_n or τ_{allow}/τ_d	Comment
						Q2							
Maximum Slope:													
0.03	0.025	0.10	4.16	0.02	4.15	0.02	2.01	0.2	2.26	0.2	S	6.2	O.K.
Minimum Slope:													
0.06	0.025	0.23	4.35	0.05	4.33	0.05	1.02	0.2	0.79	0.1	S	30.1	O.K.
						Q25							
Maximum Slope:													
0.32	0.066	1.56	5.99	0.26	5.89	0.26	3.65	5.7	1.25	3.1	V	1.4	O.K.
Minimum Slope:													
0.66	0.079	3.91	8.14	0.48	7.93	0.49	1.41	5.5	0.35	0.6	V	7.3	O.K.

Critical Depth

Depth of Flow (Crit. Depth) Y_c ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Section Factor $Z=AD^{1/2}$ ft$^{2.5}$	Flow Rate Q ft³/s	Average Velocity V_c ft/s	Froude Number F_r (Critical) #	Uniform-Flow Critical Slope S_c ft/ft	Comment
						Q2						
0.04	0.025	0.19	4.28	0.04	4.27	0.04	0.04	0.2	1.18	1.00	0.026	Slopes Near Sc - Check Freeboard.
						Q25						
0.36	0.061	1.80	6.25	0.29	6.13	0.29	0.97	5.5	3.07	1.00	0.084	Slopes Near Sc - Check Freeboard.

check

Determination of Minimum Channel Depth & Top Width (Based on Q25)

Maximum Slope		Minimum Slope	
Minimum Channel Depth ft	Minimum Top Width T ft	Minimum Channel Depth ft	Minimum Top Width T ft
0.62	8.89	1.16	10.93

G.N. Richardson & Associates
14 N. Boylan Avenue Tel: 919-828-0577
Raleigh, NC 27603 Fax: 919-828-3899

SHEET: 9 of 10
JOB #: Flowers 06-1
DATE: 6/20/06
BY: KBS
CHKD BY: PKS

Flowers LCID Recycling Center
Drainage Channel Analysis (Grass Lined)

Channel No. DC-4

Design Parameters:

PEAK DISCHARGE, Q2 = 0.1 ft³/s Source: HydroCAD 2-Yr 24-Hr
PEAK DISCHARGE, Q25 = 2.2 ft³/s Source: HydroCAD 25-Yr 24-Hr

Bottom Width, B = 4.0 ft
Left Side Slope, z_1 = 3.0 horizontal :1 vertical
Right Side Slope, z_2 = 3.0 horizontal :1 vertical
Minimum Freeboard = 0.5 ft

Maximum Channel Slope, S_{max} = 0.060 ft/ft
Minimum Channel Slope, S_{min} = 0.015 ft/ft

Permanent Grass Lining:
Grass Retardance = D
K = 34.6
V_{allow} = 4.5 ft/sec
τ_{allow} = 0.60 lb/ft²

Temporary Lining: NONE
RECP Product Name = ~~NA Green Curlex I or equal~~
Manning's Coefficient, n = 0.025
τ_{allow} = ~~1.55~~ lb/ft²

≤ 2 O.K.

Normal Depth

Depth of Flow (Norm. Depth) Y_n ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Average Velocity V_n ft/s	Flow Rate Q ft³/s	Froude Number F_r (Normal) #	Maximum Shear Stress τ_d lb/ft²	Allowable Velocity (V) or Sh. Stress (S) Used?	Factor of Safety V_{allow}/V_n or τ_{allow}/τ_d	Comment
Q2													
Maximum Slope:													
0.02	0.025	0.06	4.09	0.01	4.09	0.01	0.88	0.1	1.27	0.1	S	27.6	O.K.
Minimum Slope:													
0.03	0.025	0.10	4.16	0.02	4.15	0.02	0.61	0.1	0.69	0.0	S	66.2	O.K.
Q25													
Maximum Slope:													
0.31	0.096	1.50	5.93	0.25	5.83	0.26	1.52	2.3	0.53	1.1	V	3.9	O.K.
Minimum Slope:													
0.48	0.106	2.58	7.00	0.37	6.85	0.38	0.88	2.3	0.25	0.4	V	10.1	O.K.

Critical Depth

Depth of Flow (Crit. Depth) Y_c ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Section Factor $Z=AD^{1/2}$ ft$^{2.5}$	Flow Rate Q ft³/s	Average Velocity V_c ft/s	Froude Number F_r (Critical) #	Uniform-Flow Critical Slope S_c ft/ft	Comment
Q2												
0.02	0.025	0.10	4.16	0.02	4.15	0.02	0.02	0.1	0.89	1.00	0.031	Slopes Near Sc - Check Freeboard.
Q25												
0.21	0.204	0.95	5.30	0.18	5.23	0.18	0.40	2.3	2.41	1.00	1.089	Flow is Stable.

check

Determination of Minimum Channel Depth & Top Width (Based on Q25)

Maximum Slope		Minimum Slope	
Minimum Channel Depth ft	Minimum Top Width T ft	Minimum Channel Depth ft	Minimum Top Width T ft
0.81	8.83	0.98	9.85

G.N. Richardson & Associates
14 N. Boylan Avenue
Raleigh, NC 27603
Tel: 919-828-0577
Fax: 919-828-3899

SHEET: 10 / 10
JOB #: Flowers 06-1
DATE: 6/20/06
BY: KBS
CHKD BY: PKS

Flowers LCID Recycling Center
Drainage Channel Analysis (Grass Lined)

Channel No. DC-5

Design Parameters:

PEAK DISCHARGE, Q2 = 0.1 ft³/s Source: HydroCAD 2-Yr 24-Hr
PEAK DISCHARGE, Q25 = 2.1 ft³/s Source: HydroCAD 25-Yr 24-Hr

Bottom Width, B = 3.0 ft
Left Side Slope, z_1 = 3.0 horizontal :1 vertical
Right Side Slope, z_2 = 3.0 horizontal :1 vertical
Minimum Freeboard = 0.5 ft

Maximum Channel Slope, S_{max} = 0.080 ft/ft
Minimum Channel Slope, S_{min} = 0.028 ft/ft

Permanent Grass Lining:
Grass Retardance = D
K = 34.6
V_{allow} = 4.5 ft/sec
τ_{allow} = 0.60 lb/ft²

Temporary Lining: NONE
RECP Product Name = ~~NA Green Gurtex 1, or equal~~
Manning's Coefficient, n = 0.025
τ_{allow} = ~~1.55~~ lb/ft²

≤ 2 O.K.

Normal Depth

Depth of Flow (Norm. Depth) Y_n ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Average Velocity V_n ft/s	Flow Rate Q ft³/s	Froude Number F_r (Normal) #	Maximum Shear Stress τ_d lb/ft²	Allowable Velocity (V) or Sh. Stress (S) Used?	Factor of Safety V_{allow}/V_n or τ_{allow}/τ_d	Comment
Q2													
Maximum Slope:													
0.03	0.025	0.08	3.16	0.02	3.15	0.02	1.41	0.1	1.60	0.1	S	12.4	O.K.
Minimum Slope:													
0.04	0.025	0.11	3.22	0.03	3.21	0.03	1.03	0.1	0.99	0.1	S	25.8	O.K.
Q25													
Maximum Slope:													
0.31	0.093	1.19	4.93	0.24	4.83	0.25	1.76	2.1	0.62	1.5	V	3.0	O.K.
Minimum Slope:													
0.43	0.101	1.82	5.69	0.32	5.55	0.33	1.14	2.1	0.35	0.7	V	6.2	O.K.

Critical Depth

Depth of Flow (Crit. Depth) Y_c ft	Manning's Roughness Coefficient n	Area of Flow A ft²	Wetted Perimeter P ft	Hydraulic Radius $R=A/P$ ft	Top Width T ft	Hydraulic Depth $D=A/T$ ft	Section Factor $Z=AD^{1/2}$ ft$^{2.5}$	Flow Rate Q ft³/s	Average Velocity V_c ft/s	Froude Number F_r (Critical) #	Uniform-Flow Critical Slope S_c ft/ft	Comment
Q2												
0.03	0.025	0.11	3.22	0.03	3.21	0.03	0.02	0.1	1.04	1.00	0.028	Slopes Near Sc - Check Freeboard.
Q25												
0.23	0.133	0.83	4.42	0.19	4.35	0.19	0.36	2.0	2.47	1.00	0.456	Flow Is Stable.

✓ check

Determination of Minimum Channel Depth & Top Width (Based on Q25)

Maximum Slope		Minimum Slope	
Minimum Channel Depth ft	Minimum Top Width T ft	Minimum Channel Depth ft	Minimum Top Width T ft
0.81	7.83	0.93	8.55

Outlet Protection Analysis

G.N. Richardson & Associates

ENGINEERING AND GEOLOGICAL SERVICES

Flowers LCID Recycling Center
Outlet Protection Summary

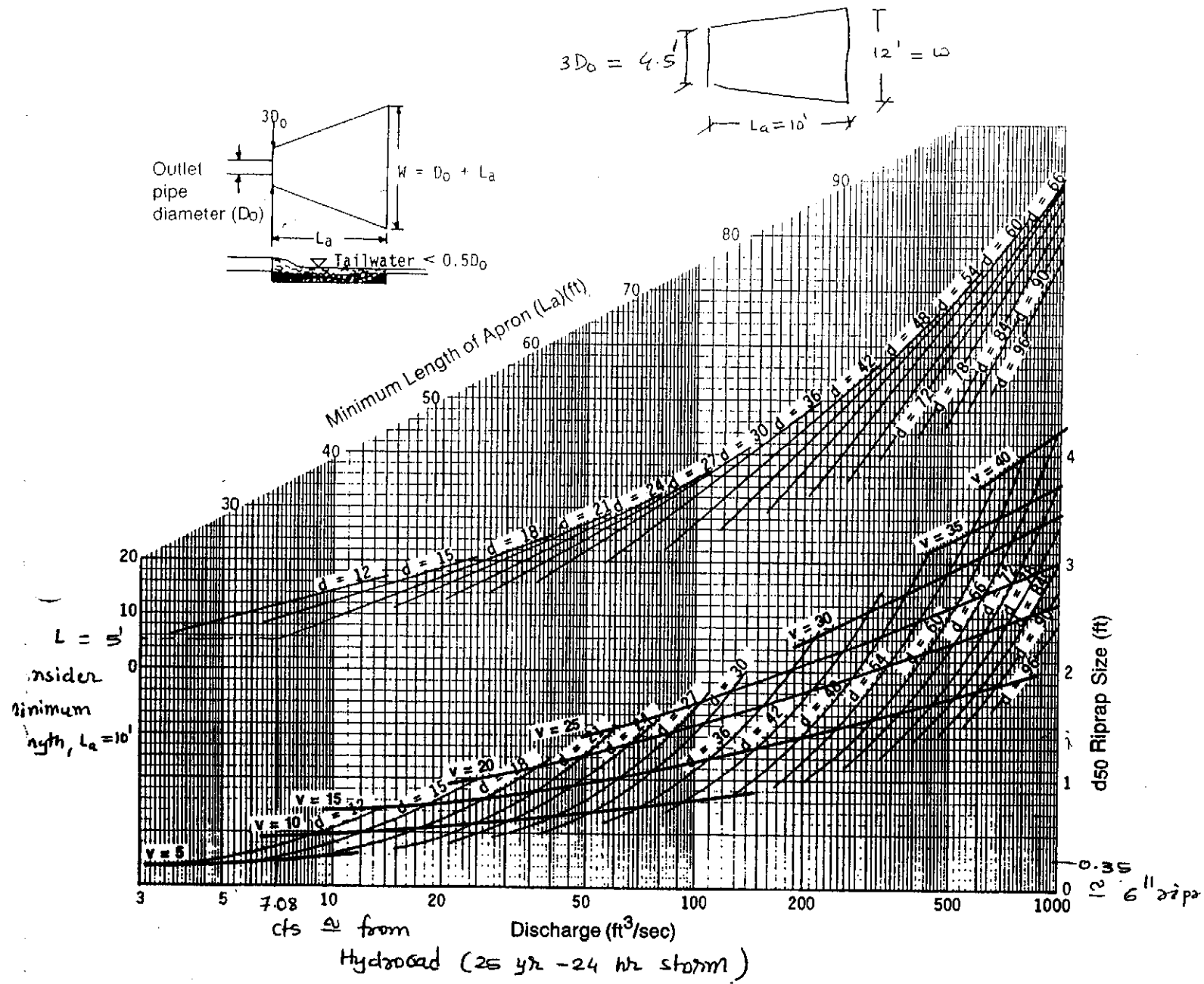
JOB #: Flowers 06-1
DATE: 5/31/2006
BY: KBS
CHKD BY:

LOCATION	PIPE DIAMETER (INCHES)	APRON LENGTH (FT)	APRON WIDTH (FT)	APRON THICKNESS (INCHES)	RIP RAP D50 (INCHES)
SED. BASIN A	18	10	12	24	6
SED. BASIN B	18	10	12	24	6
AT THE END OF ROADWAY CULVERT	24	10	12	24	6

Date: 5/26/06
By: KBS
✓ PKS
Appendices

Riprap Outlet protection for Basin - B

2/3



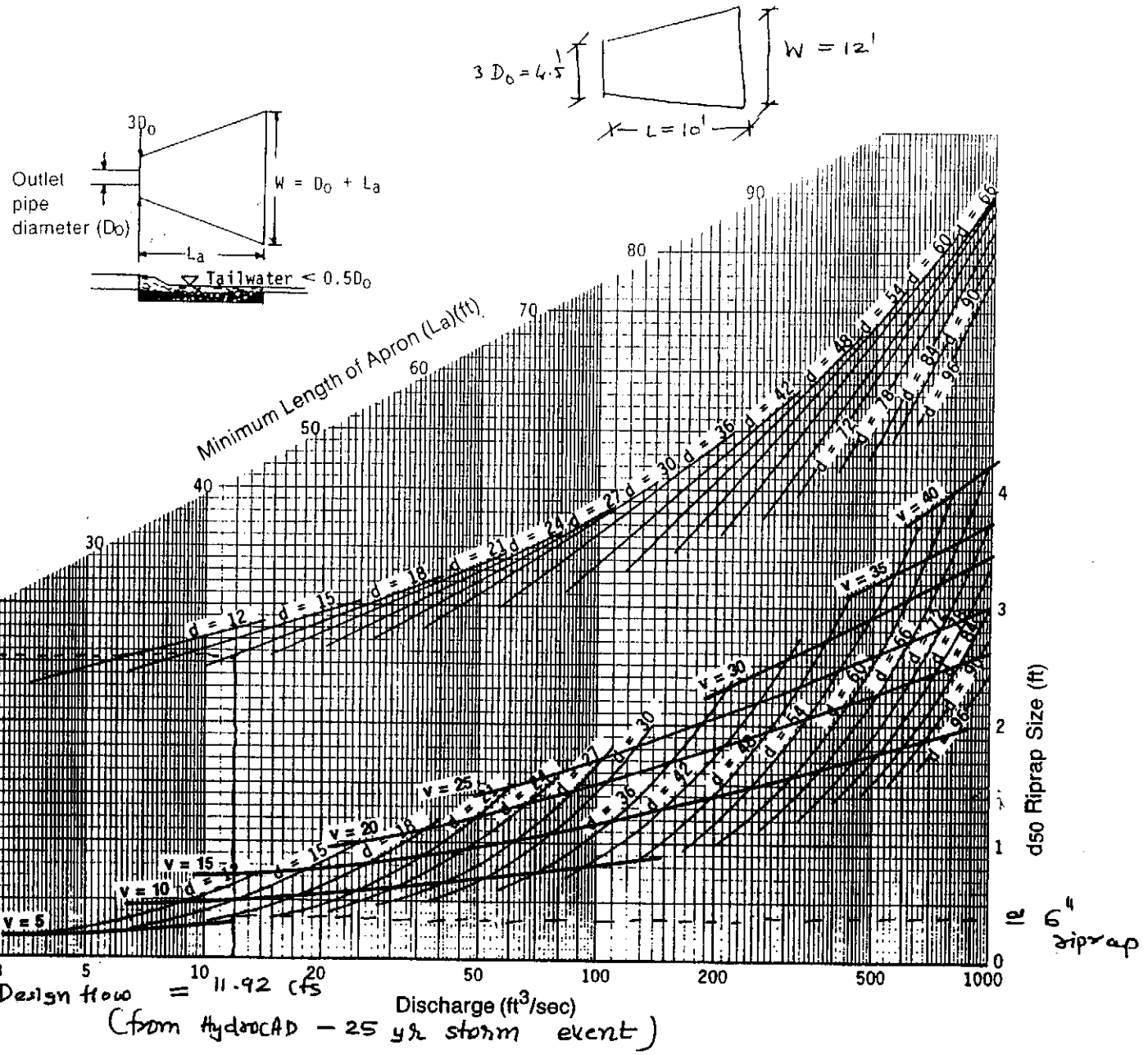
L = 5'
nsider
inimum
ngth, L_a = 10'

Curves may not be extrapolated.

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

Note: In above case, outflow from Basin B (found by HydroCAD) was very less. So, design flow was considered same as inflow.

Riprap Outlet protection for Basin A



Curves may not be extrapolated.

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

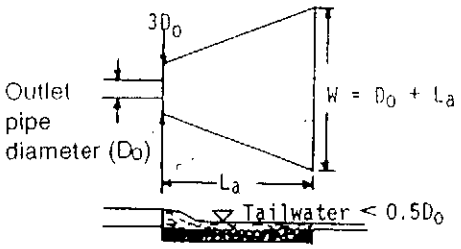
In above case, design flow was considered same as inflow.

Date : 5/26/0
BY : KBS

outlet protection for Roadway culvert

$3D_o = 6'$ $\quad 12' = 6$

$L = 10'$



: 2'
onsider
in. length
L = 10'

utflow = 3.71 cfs
(From 25 yr - 24 hr storm)

0.3 12 0.8 1
Riprap

Curves may not be extrapolated.

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

Appendix B

Erosion & Sedimentation Control
Technical Specifications

42 EAST LLC,
FLOWERS LCID RECYCLING CENTER

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

SECTION 02110

SITE PREPARATION

Site Preparation: Site Preparation includes clearing, grubbing, and stripping operations which precede the proposed construction.

A. DESCRIPTION

1. General:

a. The Contractor shall furnish all labor, material, and equipment to complete Site Preparation in accordance with the Contract Drawings and these Specifications.

b. Principal items of work include:

1. Notifying all authorities owning utility lines running to or on the property. Protect and maintain all utility lines to remain and cap those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.

2. Clearing the site within the clearing limits, including removal of grass, brush, shrubs, trees, loose debris, and other encumbrances except for trees to remain.

3. Boxing and protecting all areas to be preserved.

4. Removing all topsoil from designated areas and stockpiling on site where directed by the Engineer for future use.

5. Disposing from the site all debris resulting from work under this Section.

B. MATERIALS Not Used.

C. SUBMITTALS Not Used.

D. CONSTRUCTION

1. Clearing of the Site:

a. Clearing limits, as shown on the Contract Drawings, shall be established by the Contractor's Surveyor. Once established, the clearing limits shall be inspected and approved by the Engineer prior to clearing the affected areas.

b. Before removal of topsoil, and start of excavation and grading operations, the areas within the clearing limits shown on the Contract Drawings shall be cleared and grubbed.

c. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, fencing, and other perishable and objectionable material within the areas to be excavated or other designated areas.

Should it become necessary to remove a tree, bush, brush, or other plants adjacent to the area to be excavated, the Contractor shall do so only after permission has been granted by the Engineer.

d. Excavation resulting from the removal of trees, roots, and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted per the requirements contained in Section 02223, Embankment, of these Specifications.

e. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional cost to the Owner, if such, in his opinion, they are too close to the work to be maintained or have become damaged due to the Contractor's operations.

2. Stripping and Stockpiling Existing Topsoil:

a. Existing topsoil and sod on the site within areas designated on the Contract Drawings shall be stripped to whatever depth it may occur, and stored in locations directed by the Engineer.

b. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling.

c. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.

3. Grubbing:

a. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks, and other perishable materials to a depth of at least 6 inches below ground surfaces.

b. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

4. Disposal of Cleared and Grubbed Material:

All trees, stumps, roots, bushes, and refuse shall be processed by chipping and/or grinding or shall be removed from the site and disposed of by the Contractor. On-site and off-site disposal areas are subject to approval by the Engineer.

END OF SECTION

SECTION 02222

EXCAVATION

Excavation: Excavation includes excavating, sealing, hauling, scraping, undercutting, removal of accumulated surface water or ground water, stockpiling, and all necessary and incidental items as required for bringing the processing areas and related structures to the specified lines and grades.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment required to complete Excavation of the composting areas and related structures in accordance with the Contract Drawings and these Specifications, except as noted below:

a. Clearing and grubbing and removal of topsoil is addressed in Section 02110, Site Preparation, of these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Site Preparation	02110
Embankment	02223
Erosion and Sedimentation Control	02270
Roadway Work	02500

3. Definitions:

a. Excavation: shall consist of the removal and satisfactory disposal and/or stockpiling of materials located with the limits of construction including widening cuts and shaping of slopes necessary for the preparation of roadbeds, slope areas, cutting of any ditches, channels, waterways, entrances, and other work incidental thereto.

b. Borrow: shall consist of approved on-site material required for the construction of embankments/fills or for other portions of the work.

c. Select Borrow: shall consist of approved off-site material required for the construction of embankments/fills, roadway subgrade, backfilling, or for other portions of the work as shown on Contract Drawings or in these Specifications. The Contractor shall make his own arrangements for obtaining select borrow and pay all costs involved.

d. Unsuitable Material: is any in-place or excavated material which contains undesirable materials, or is in a state which is not appropriate; in the opinion of the CQA Engineer, for the intended use or support of planned structures, embankment, or excavation. This may include but not be limited to organic material, waste/refuse, soft, or wet material not meeting required specifications, etc.

e. Unsuitable Materials Excavation (Overexcavation): shall consist of the removal and satisfactory disposal of all unsuitable material located within the limits of construction. Where excavation to the finished grade section shown results in a subgrade or slopes of unsuitable material, the Contractor shall overexcavate such material to below the grade shown on the Contract Drawings or as directed by the Engineer and CQA Engineer.

B. MATERIALS

Excavation shall include the removal of all soil, weathered rock, boulders, conduits, pipe, and all other obstacles encountered and shown on the Contract Drawings or specified herein.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer before approval is given to proceed:

1. Plans of open cut excavations showing side slopes and limits of the excavation at grade.

2. List of disposal site(s) for waste and unsuitable materials.

3. Descriptive information on Excavation equipment to be used.

D. CONSTRUCTION

1. The Contractor shall conduct Excavation activities in such a manner that erosion of disturbed areas and off site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. The Contractor shall excavate to the lines and grades shown on the Contract Drawings and stockpile all suitable excavated materials. As the excavation is made, the materials will be examined and identified to the CQA Engineer.

   The Contractor will perform all surveys necessary to establish and verify lines and grades for all Excavation, including pipe excavations, soil overexcavation, and anchor trenches.

3. Stockpiling:

   The Contractor shall stockpile the materials in appropriate stockpiles as approved by the CQA Engineer. The Contractor shall use equipment and methods as necessary to maintain the moisture content of soils stockpiled (excluding topsoil) at or near their optimum moisture content.

   Stockpiles shall be properly sloped and the surfaces sealed by the Contractor at the end of each working day, or during the day in the event of heavy rain, to the satisfaction of the Engineer.

4. The Contractor shall protect all existing facilities and structures including, but not limited to, existing utilities, monitoring wells, signs, grade stakes, etc. during the grading and stockpiling operations.

5. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such sheeting, timbering, pumping, and drainage as may be required.

6. Excavation slopes shall be flat enough to avoid sloughs and slides that will cause disturbance of the subgrade or damage of adjacent areas. Slides and overbreaks which occur due to negligence, carelessness, or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as directed by the Engineer at no additional cost to the Owner.

7. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded. All protruding roots and other vegetation shall be removed from slopes.

8. The bottom of all excavations for structures and pipes shall be examined by the CQA Engineer for bearing value and the presence of unsuitable material. If, in the opinion of the CQA Engineer, additional Excavation is required due to the low bearing value of the subgrade material, or if the in-place materials are soft, yielding, pumping and wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted structural fill, or material directed by the CQA Engineer. No payment will be made for subgrade disturbance caused by inadequate Dewatering or improper construction methods.

9. Any areas excavated below design subgrade elevations by the Contractor, unless directed by the CQA Engineer, shall be brought back to design elevations at no cost to the Owner. The Contractor shall place and compact such material in accordance with Section 02223, Embankment, of these Specifications.

10. The Contractor shall dispose of excess or unsuitable excavation materials on-site at location(s) approved by the Owner.

11. The Contractor shall properly level-off bottoms of all excavations. Proof-rolling shall be conducted with appropriate equipment.

12. Upon reaching subgrade elevations shown in excavation areas, the Contractor shall scarify subgrade soils to a minimum depth of 6" and obtain the CQA Engineer's approval of quality. If unsuitable materials are encountered at the subgrade elevation, perform additional excavations as approved by the CQA Engineer to remove unsuitable materials.

13. Overexcavation and Backfill:

    Where subgrade materials are determined to be unsuitable, such materials shall be removed by the Contractor to the lengths, widths and depths approved by the CQA Engineer and backfilled with suitable material in accordance with Section 02223, Embankment, of these Specifications unless further excavation or earthwork is required. No additional payment will be made for such excavation and backfill 0.5 feet or less than the finished subgrade. Unsuitable material excavation greater than 0.5 feet beneath the finished subgrade shall be made on a unit price basis for excavation and backfill, only as approved by the Engineer and CQA Engineer prior to the work. Unit price for overexcavation and backfill greater than 0.5 feet in depth shall include disposal of unsuitable materials.

14. All cuts shall be brought to the grade and cross section shown on the Contract Drawings, or established by the Engineer, prior to final inspection.

15. The Contractor shall protect finished lines and grades of completed excavation against excessive erosion, damage from trafficking, or other causes and shall repair any damage at no additional cost to the Owner.

16. Trench Excavation:

a. All pipe Excavation and trenching shall be done in strict accordance with these Specifications, all applicable parts of the OSHA Regulations, 29 CFR 1926, Subpart P, and other applicable regulations. In the event of any conflicts in this information, safe working conditions as established by the appropriate OSHA guidelines shall govern.

b. The minimum trench widths shall be as indicated on the Contract Drawings. Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Contract Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing.

c. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.

d. Hand excavation shall be employed wherever, in the opinion of the Engineer, it is necessary for the protection of existing utilities, poles, trees, pavements, obstructions, or structures.

e. No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the Engineer and, in general, such length shall be limited to approximately one hundred (100) feet.

f. Pipe Bedding: All pipe bedding shall be as shown on the Contract Drawings, unless otherwise specified herein.

17. Sheeting and Bracing:

a. The Contractor shall furnish, place, and maintain such sheeting and bracing which may be required to support sides of Excavation or to protect pipes and structures from possible damage and to provide safe working conditions in accordance with current OSHA requirements. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports put in at the sole expense of the Contractor. The Contractor shall be responsible for the adequacy of all sheeting and bracing used and for all damage resulting from sheeting and bracing failure or from placing, maintaining, and removing it.

b. The Contractor shall exercise caution in the installation and removal of sheeting to insure that excessive or unusual loadings are not transmitted to any new or existing structure. The Contractor shall promptly repair at his expense any and all damage that can be reasonably attributed to sheeting installation or removal.

c. All sheeting and bracing shall be removed upon completion of the work.

18. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed at the Contractor's sole expense.

END OF SECTION

SECTION 02223

EMBANKMENT

Embankment: Embankment is the on-site compacted fill that provides the foundation for the berms for the sediment basins, the subgrade for some access roadways and structures, and backfill around structures and piping.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Embankment including borrowing, hauling, screening, discing, drying, compaction, control of surface and subsurface water, final grading, sealing, and all necessary and incidental items as detailed or required to complete the Embankment, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Excavation	02222
Erosion and Sedimentation Control	02270
Roadway Work	02500

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
ASTM D 2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 3017	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.

4. Definitions:

a Embankment: Shall include construction of all site earthwork including roadways, subgrade, perimeter berm embankments, including preparation of the areas upon which materials are to be placed. Embankment may also be referred to as structural and/or controlled fill. All Embankment materials may be either (off-site) Select Borrow or (on-site) Borrow unless otherwise noted on Contract Drawings or specified by the Engineer.

b. Prepared Subgrade: The ground surface after clearing, grubbing, stripping, excavation, scarification, and/or compaction, and/or proof rolling to the satisfaction of the CQA Engineer.

c. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Well-graded is used to define a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

d. Unclassified Fill: The nature of materials to be used is not identified or described herein but must be approved by the Engineer prior to use.

B. MATERIALS

1. Embankment materials shall consist of clean well-graded natural soil classified as SM, SP, SC, ML, MH, CL-ML, CL or CH (ASTM D 2488) containing no topsoil or other deleterious material. Other material classifications may be approved by the Engineer.

2. Stones or rock fragments shall not exceed one half the maximum lift thickness as compacted in any dimension.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer before approval is given to proceed:

1. Descriptive information on compaction equipment to be used for construction of Embankment and appurtenant structures.

2. Descriptive information on the location and source of any off-site borrow material to be used for Embankment, where applicable. Information shall include Standard Proctor curves (ASTM D698) for each borrow material.

D. CONSTRUCTION

1. The Contractor shall conduct Embankment activities in such a manner that erosion of disturbed areas and off-site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. All placement and compaction of Embankment shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.

3. Embankment shall be placed and compacted to the lines and grades shown on the Contract Drawings. Placement of Embankment outside the construction limits shall occur only as directed and approved by the Engineer.

   The Contractor will perform all surveys necessary to establish and verify lines and grades for all Embankment.

4. The Contractor shall protect all existing facilities including, but not limited to, utilities and monitoring wells.

5. Subgrade Preparation:

   a. The CQA Engineer shall inspect the exposed subgrade prior to placement of Embankment to assure that all rocks, topsoil, vegetation, roots, debris, or other deleterious materials have been removed.

   b. Prior to placement of Embankment, the exposed subgrade shall be proofrolled using a static smooth-drum roller, loaded tandem axle dump truck, or other suitable equipment in the presence of the CQA Engineer. Any soft or unsuitable materials revealed before or during the in-place compaction shall be removed as directed by the CQA Engineer and replaced with suitable Embankment.

6. Surfaces on which Embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the Embankment with the existing surface.

7. The Contractor shall be responsible for preparing the materials for the Embankment, including but not limited to, in-place drying or wetting of the soil necessary to achieve the compaction criteria of these Specifications.

8. Embankment materials shall be placed in a manner permitting drainage and in continuous, approximately horizontal layers.

9. Compaction Requirements:

   a. The Contractor shall compact Embankment in accordance with the requirements shown in Table 1 of this section. If Embankment does not meet the specified requirements, the Contractor shall rework the material, as may be necessary and continue compaction to achieve these requirements, or remove and replace the material to achieve the specified requirements, at Contractor's expense.

   b. Each lift shall be compacted prior to placement of succeeding lifts. In confined areas, mechanical equipment, suitable for small areas and capable of achieving the density requirements, shall be required.

   c. Lift compaction shall be performed with an appropriately heavy, properly ballasted, penetrating-foot or smooth-drum vibratory compactor depending on soil type. Compaction equipment shall be subject to approval by the CQA Engineer.

10. Embankment that becomes excessively eroded, soft, or otherwise unsuitable shall be removed or repaired by the Contractor as directed by the CQA Engineer, at no cost to the Owner.

11. The exposed surface of Embankment shall be rolled with a smooth-drum roller at the end of each work day to protect from adverse weather conditions.

12. Where Embankment is to be placed and compacted on slopes that are steeper than 3:1, the subgrade shall be benched to a minimum depth of 6 inches and the Embankment shall be placed in horizontal lifts.

13. Backfilling for Structures and Piping:

    a. All structures, including manholes and pipes shall be backfilled with Embankment as shown in the Contract Drawings and as described in these Specifications.

    b. Where sheeting is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when sheeting is removed. If significant volumes of soil cannot be prevented from clinging to the extracted sheets, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below subgrade that sheeting will be driven in similar soil conditions or employ other appropriate means to prevent loss of support.

    c. When backfilling around structures, do not backfill until concrete has sufficiently cured (as determined by the CQA Engineer) and is properly supported. Place backfill in a manner to avoid displacement or damage of structures.

TABLE 1: REQUIRED EMBANKMENT PROPERTIES

ITEM	Required % Standard Proctor (ASTM D698)	Maximum Lift Thickness (Compacted) (inches)
Embankment	95	8
Embankment Beneath Structures and Roads[1]	98	8
Backfill Around Structures	95	8
Backfill in Pipe Trenches	95	6
Unclassified Fill	N/A	N/A

Notes:

1. Embankment beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope. Embankment beneath roads shall be considered to include all embankment placed within 2 vertical feet of the final wearing surface and shall also include shoulders.

END OF SECTION

SECTION 02240

GEOTEXTILES

Geotextiles: For the proposed construction, a Type GT-S (Separator/Filter) Geotextile is specified. The Type GT-S Geotextile will be placed beneath rip rap in outlet protection and between soil subgrade and aggregate in access roads.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Geotextiles including all necessary and incidental items as detailed or required for the Contractor to complete the installation in accordance with the Contract Drawings and these Specifications, except as noted below:

a. Geotextiles used as a Silt Fence is covered under Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Erosion and Sedimentation Control	02270
Roadway Work	02500

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) and the American Association of State Highway and Transportation Officials (AASHTO) are hereby made a part of these specifications.

ASTM D 3786 Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.

ASTM D 4355 Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).

ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
ASTM D 5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
AASHTO M 288	Standard Specification for Geotextiles.

B. MATERIALS

1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

Labels on each roll of Geotextile shall identify the length, width, lot and roll numbers, and name of Manufacturer.

2. The Type GT-S Geotextile shall be a woven, nonwoven spunbonded, or nonwoven needlepunched synthetic fabric consisting of polyester or polypropylene manufactured in a manner approved by the Engineer.

3. All Geotextiles shall conform to the properties listed in Table 1 of this section.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit one copy of a mill certificate or affidavit signed by a legally authorized

official of the Manufacturer for each type of Geotextile attesting that the Geotextiles meet the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample (4" x 6") of each Geotextile to be used. The samples shall be labeled with the product name and be accompanied by the Manufacturer's specifications.

2. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.

3. Quality Control Certificates: For Geotextiles delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided which represent every roll of each type of Geotextile supplied. Each certificate shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall be as shown in Table 2 of this section.

4. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

D. CONSTRUCTION

1. Shipping, Handling, and Storage:

All Geotextiles shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Failing CQA Material Control Tests:

Geotextiles that are rejected upon testing shall be removed from the project site and replaced at Contractor's cost. Sampling and CQA testing of Geotextiles supplied as replacement for rejected material shall be performed by the CQA Engineer at Contractor's cost.

3. Installation of Geotextiles:

a. The surface receiving the Geotextiles shall be prepared to a relatively smooth condition, free of obstructions, excessive depressions, debris, and very soft or loose pockets of soil. This surface shall be approved by the CQA Engineer prior to Geotextile placement.

b. Geotextiles shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, Geotextiles shall be rejected by the CQA Engineer if they have defects, rips, holes, flaws, evidence of deterioration, or other damage.

c. The Geotextiles shall be placed smooth and free of excessive wrinkles.

d. On slopes, Geotextiles shall be anchored at the top and unrolled down the slope. In the presence of wind, all Geotextiles shall be weighted with sandbags or other material as approved by the CQA Engineer. Geotextiles uplifted by wind may be reused upon approval by the CQA Engineer.

4. Seams:

a. All Geotextile seams shall be sewn. On slopes greater than 10 percent, all seams shall be oriented parallel to (in the direction of) the slope unless otherwise approved by the Engineer.

b. Seams to be sewn shall be sewn using a Type 401 stitch. One or two rows of stitching may be used. Each row of stitching shall consist of 4 to 7 stitches per inch. The minimum distance from the geotextile edge to the stitch line nearest to that edge (seam allowance) shall be 1.5 inches if a Type SSa (prayer or flat) seam is used. The minimum seam allowance for all other seam types shall be 1.0 inches. All seams must be approved by the CQA Engineer.

c. Alternately, the Contractor may overlap or heat bond adjacent panels with methods approved by the Engineer.

5. Repair Procedures:

a. Any Geotextile that is torn or punctured shall be repaired or replaced, as directed by the CQA Engineer, by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of the same type of Geotextile placed over the failed areas and shall overlap the existing Geotextile a minimum of 18 inches from any point of the rupture. Patches shall be spot sewn so as not to shift during cover placement.

b. Slopes Less Than or Equal to 10 Percent: Damaged areas of a size exceeding 10 percent of the roll width shall be removed and replaced across the entire roll width with new material. Damaged areas of a size less than 10 percent of the roll width may be patched.

c. Slopes Greater Than 10 Percent: Geotextile panels which require repair shall be removed and replaced with new material. Replacement material shall be sewn as previously described in this specification.

6. Cover Placement:

Placement of cover over Geotextiles shall be performed in a manner as to ensure that the Geotextiles are not damaged. Cover material shall be placed such that excess tensile stress is not mobilized in the Geotextile.

TABLE 1: REQUIRED GEOTEXTILE PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE[1]
			TYPE GT-S
Geotextile Construction (NW = Nonwoven) (W = Woven)	----------	----------	NW[2] or W[3]
Mass per Unit Area (Unit Weight)	ASTM D 5261	oz/yd^2	N/A
Ultraviolet Resistance (500 hrs)	ASTM D 4355	%	70
Strength Class[4]	AASHTO M 288	Class	2
Grab Tensile Strength	ASTM D 4632	lbs	160 (NW) 250 (W)
Grab Tensile Elongation	ASTM D 4632	%	$\geq$ 50 (NW) < 50 (W)
Puncture Resistance	ASTM D 4833	lbs	55 (NW) 90 (W)
Trapezoidal Tear Strength	ASTM D 4533	lbs	55 (NW) 90 (W)
Burst Strength	ASTM D 3786	psi	200 (NW) 400 (W)
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	70+
Permittivity	ASTM D 4491	sec^{-1}	1.0

Notes:

1. Minimum Average Roll Value (MARV).
2. Nonwoven geotextiles that have been heat calendered are not acceptable, unless approved by the Engineer in advance.
3. Woven geotextiles formed exclusively with slit film fibers are not acceptable.
4. AASHTO M 288 criteria includes the above listed requirements for: Grab Tensile Strength, Grab Tensile Elongation, Puncture Resistance, Trapezoidal Tear Strength, and Burst Strength.

TABLE 2: REQUIRED MANUFACTURER'S QUALITY CONTROL TEST DATA

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
Mass per Unit Area (Unit Weight)	ASTM D 5261	200,000 ft^2
Ultraviolet Resistance (500 hrs)	ASTM D 4355	Periodic
Grab Tensile Strength	ASTM D 4632	200,000 ft^2
Grab Tensile Elongation	ASTM D 4632	200,000 ft^2
Burst Strength (Diaphragm Methods)	ASTM D 3786	200,000 ft^2
Apparent Opening Size (AOS)	ASTM D 4751	Periodic
Permittivity	ASTM D 4491	Periodic
Puncture Resistance	ASTM D 4833	200,000 ft^2
Trapezoidal Tear Strength	ASTM D 4533	200,000 ft^2

END OF SECTION

SECTION 02270

EROSION AND SEDIMENTATION CONTROL

Erosion and Sedimentation Control: Erosion and Sedimentation Control is a system of construction practices and engineered structures which act to minimize surface water induced erosion of disturbed areas and resulting sedimentation off-site.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of and maintain Erosion and Sedimentation Control facilities and other construction in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Geotextiles	02240
Rip Rap	02271
Storm Water Systems	02720
Revegetation	02930

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

ASTM D 3786	Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
ASTM D 4355	Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

B. MATERIALS

1. Permanent Sediment Basins:

Permanent sediment basins shall be constructed as shown on the Contract Drawings.

2. Permanent Ditches, Swales, and Drainage Channels:

Permanent ditches, swales, and drainage channels shall be constructed as shown on the Contract Drawings.

3. Silt Fence:

Silt fences shall be constructed as shown on the Contract Drawings and as needed, based on the Contractor's discretion and Engineer's approval. The silt fence is a permeable barrier erected within and downgradient of small disturbed areas to capture sediment from sheet flow. It is made of filter fabric buried at the bottom, stretched, and supported by posts and wire mesh backing. Silt fence shall conform to the following properties:

a. Posts: Posts shall be 3 feet long "U" or "T"-type steel or wood posts.

b. Filter Fabric: Filter fabric shall be a woven geotextile made specifically for sediment control. Filter fabric shall conform to the properties listed in Table 1 of this section.

4. Geotextiles:

Geotextiles shall conform to the requirements of Section 02240, Geotextiles, of these Specifications.

5. Temporary Sediment Traps:

Temporary sediment traps shall be constructed as shown on the Contract Drawings.

6. Stone Check Dams:

Stone check dams shall be constructed as shown on the Contract Drawings.

7. Pipes:

Pipes shall be constructed as shown on the Contract Drawings.

8. Rip Rap:

Rip Rap shall conform to the requirements of Section 02271, Rip Rap, of these Specifications.

9. Other Work:

In addition to the erosion control measures shown on the Contract Drawings, the Contractor shall provide adequate means to prevent any sediment from entering any storm drains, drop inlets, ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed upstream of any trench or other excavation to prevent sedimentation of off-site areas. In areas where a natural buffer area exists between the work area and the closest stream or water course, this area shall not be disturbed. All paved areas shall be scraped and swept as necessary to prevent the accumulation of dirt and debris. Work associated with this provision shall be considered incidental to the project and no separate payment will be made.

10. Temporary and Permanent Ground Cover:

Disturbed areas left inactive between any phase of grading shall be temporarily seeded within 15 working days or 30 calendar days, whichever is shorter. Provisions for permanent groundcover must be accomplished on exposed slopes 21 calendar days, and in remaining areas within 15 working days or 90 calendar days, whichever is shorter.

C. SUBMITTALS

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all Erosion and Sedimentation Control materials manufactured for the project have been produced in accordance with these Specifications.

2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. CONSTRUCTION

1. Establishment of Erosion Control Devices:

a. All erosion control structures will be constructed according to the Contract Drawings and these Specifications.

b. Due to the nature of the work required by this Contract, it is anticipated that the location and nature of the erosion control devices may need to be adjusted on several occasions to reflect the current phase of construction.

c. Erosion control devices shall be established prior to the work in a given area. Where such practice is not feasible, the erosion control device(s) shall be established immediately following completion of the clearing operation.

d. The construction schedule adopted by the Contractor will impact the placement and need for specific devices required for the control of erosion. The Contractor shall develop and implement such additional techniques as may be required to minimize erosion and off-site sedimentation.

e. The location and extent of erosion control devices shall be revised at each phase of construction that results in a change in either the quantity or direction of surface runoff from construction areas. All deviations from the control provisions shown on the Contract Drawings shall have the prior approval of the Engineer.

2. Maintenance of Erosion Control Devices:

a. The Contractor shall furnish the labor, material, and equipment required for maintenance of all erosion control devices. Maintenance shall be scheduled as required for a particular device to maintain the removal efficiency and intent of the device.

b. All erosion control devices shall be inspected immediately after each significant rainfall event, and appropriate maintenance conducted.

c. Maintenance shall include, but not be limited to:

(1) The removal and satisfactory disposal of trapped sediments from basins or silt barriers;

(2) Replacement of filter fabrics used for silt fences upon loss of specified efficiency; and

(3) Replacement of any other components which are damaged or cannot serve the intended use.

d. Sediments removed from erosion control devices shall be disposed of in locations that will not result in off-site sedimentation as approved by the Engineer.

e. All erosion control structures shall be maintained to the satisfaction of the Engineer until the site has been stabilized.

3. Finish Grading:

All disturbed areas outside of the compost area shall be uniformly graded to the lines, grades, and elevations shown on the Contract Drawings. Finished surfaces shall be reasonably smooth, compacted, and free from irregular surface changes. Unless otherwise specified, the degree of finish shall be that ordinarily obtainable from either blade or scraper operations. Areas shall be finished to a smoothness suitable for application of topsoil.

4. Seeding:

Seeding shall conform to the requirements of Section 02930, Revegetation, of these Specifications.

5. Cleanup:

a. The Contractor shall remove from the site all subsoil excavated from his work and all other debris including, but not limited to, branches, paper, and rubbish in all landscape areas, and remove temporary barricades as the work proceeds.

b. All areas shall be kept in a neat, orderly condition at all times. Prior to final acceptance, the Contractor shall clean up the entire landscaped area to the satisfaction of the Engineer.

TABLE 1: REQUIRED SILT FENCE FILTER FABRIC PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE[1]
Grab Tensile Strength[2]	ASTM D 4632	lbs	100 x 100
Grab Elongation	ASTM D 4632	%	15 (Max.)
Trapezoidal Tear Strength[2]	ASTM D 4533	lbs	50 x 50
Burst Strength	ASTM D 3786	psi	265
Puncture Resistance	ASTM D 4833	lbs	55
Ultraviolet Resistance (500 hrs)	ASTM D 4355	%	80
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	20 (Max.)/40 (Min.)
Permittivity	ASTM D 4491	sec^{-1}	0.20

Notes:

1. Minimum Average Roll Value (MARV).
2. Values for machine and cross machine direction (MD x XD), respectively.

END OF SECTION

SECTION 02271

RIP RAP

Rip Rap: This section includes all rip rap aprons and channel protection.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Rip Rap for protection of earthen slopes against erosion as indicated, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Geotextiles	02240
Erosion and Sedimentation Control	02270

3. Reference Standards:

The latest revision of the following standards of the North Carolina Department of Transportation (NCDOT) are hereby made a part of these Specifications.

NCDOT **Standard Specifications for Roads and Structures.**

B. MATERIALS

1. Rip Rap: Rip Rap shall be of the size indicated on the Contract Drawings and shall conform to NCDOT Section 1042, Rip Rap Materials.

2. Geotextiles: Geotextiles shall conform to the requirements outlined in Section 02240, Geotextiles, of these Specifications.

C. SUBMITTALS

The Contractor shall submit the following to the Engineer:

SECTION 02500

ROADWAY WORK

Roadway Work: Roadway Work refers to the construction of gravel road surfaces and the repair and reconstruction of existing roads.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment required to complete construction of all Roadway Work including gravel roads, asphalt concrete pavement, asphalt concrete overlay, concrete pavement, concrete curb and gutter, repair and reconstruction of existing asphalt pavement, repair of existing gravel roads, and pavement markings in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Geotextiles	02240

3. Reference Standards:

The latest revision of the following standards of the North Carolina Department of Transportation (NCDOT) are hereby made a part of these Specifications:

NCDOT Standard Specifications for Roads and Structures.

B. MATERIALS

1. Geotextiles:

Geotextiles shall conform to the requirements outlined in Section 02240, Geotextiles, of these Specifications.

5. Underground Utility Lines:

Where an underground utility line is beneath the Roadway Work, backfilling shall be carried out with special care, and the final consolidation shall be accomplished by a vibratory roller. Construction of Roadway Work over the trench shall be deferred as long as practicable.

6. Junction with Other Paving:

Where new asphalt pavement abuts existing asphalt pavement, the existing pavement shall be cut back to insure obtaining the specified compaction of the new pavement courses and interlocking adjoining courses. Existing subbase courses shall be cut back from the subgrade level of the new pavement on a one-on-one slope into the existing pavement and the asphalt courses of the existing pavement shall be removed for an additional 6 inches back from the slope. The edge of the existing asphalt courses shall be saw cut straight and true. The faces between new and existing asphalt courses shall receive an application of tack coat.

Where new rigid concrete pavement abuts existing rigid concrete or asphalt paving, the existing paving shall be saw cut straight and true. An expansion joint or a ½ inch minimum thickness with a filler material and sealant shall be placed between the new concrete pavement and the existing rigid concrete or asphalt paving.

END OF SECTION

SECTION 02720

STORM WATER SYSTEMS

Storm Water Systems: Storm Water Systems shall include all piping, pipe fittings, flared end sections, and other appurtenances designated to convey stormwater.

A. DESCRIPTION

1. General:

The contractor shall furnish all labor, material, and equipment to complete installation of Storm Water Systems in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Erosion and Sedimentation Control	02270
Rip Rap	02271

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM), the American Association of State Highway and Transportation Officials (AASHTO), and the North Carolina Department of Transportation (NCDOT) are hereby made a part of these specifications.

ASTM C 76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
ASTM C 150	Standard Specification for Portland Cement.
ASTM D 1248	Standard Specification for Polyethylene Plastics Molding and Extrusion Materials For Wire and Cable.
ASTM D 2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

e. All CMP utilized for permanent installation shall have gasketed joints.

f. Asphaltic or bituminous coatings shall be applied in conformance with the manufacturer's requirements, as applicable.

3. Corrugated Polyethylene (CPE) Pipe:

CPE pipe and fittings shall be of the sizes and type shown on the Contract Drawings and shall conform to every aspect of AASHTO M 252 (3 to 10 inch diameters) or AASHTO M 294 (12 to 36 inch diameters). All Type S CPE pipe shall have watertight joints.

4. Flared End Sections:

Flared end sections shall be reinforced and shall be fabricated from the same materials meeting the same requirements as the pipe to which they are connected. Corrugated polyethylene flared end sections shall be as recommended by the pipe manufacturer.

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all Storm Water Systems have been produced in accordance with these Specifications.

2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. CONSTRUCTION

1. All piping shall be installed by skilled workmen and in accordance with the best standards for piping installation. Proper tools and appliances for the safe and convenient handling and installation of the pipe and fittings shall be used.

2. All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be defective. If any defective piece should be discovered after having been installed, it shall be removed and replaced at the Contractor's expense.

3. Excavation and backfilling of pipe trenches shall be as described in Section 02222, Excavation and Section 02223, Embankment, respectively, of these Specifications.

SECTION 02930

REVEGETATION

Revegetation: Revegetation includes permanent Revegetation of all site areas disturbed by the Contractor whether inside the Contract Limits or not.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Revegetation in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Erosion and Sedimentation Control	02270
Rolled Erosion Control Products	02275

3. Warranty:

The Contractor shall be responsible for the satisfactory establishment and growth of a permanent stand of vegetation for a period of one year following the final seeding as judged by the Engineer. During this period, the Contractor shall be responsible for the maintenance items described in Section D.4 of this Specification.

B. MATERIALS

1. Limestone: Unless otherwise defined by specific soil tests, supply agricultural grade ground limestone conforming to the current "Rules, Regulations, and Standards of the Fertilizer Board of Control."

2. Fertilizer: Unless otherwise defined by specific soil tests, supply commercial fertilizer of 10-20-10 analysis, meeting applicable requirements of State and Federal law. Do not use cyanamic compounds of hydrated lime. Deliver fertilizer in original containers labeled with content analysis.

2. Soil Preparation:

a. Limit preparation to areas which will be planted soon after preparation.

b. Loosen surface to minimum depth of four (4) inches.

c. Remove stones, sticks, roots, rubbish and other extraneous matter over three (3) inches in any dimension.

d. Spread lime uniformly over designated areas at the rate specified in Table 1 of this section.

e. After application of lime, prior to applying fertilizer, loosen areas to be seeded with double disc or other suitable device if soil has become hard or compacted. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.

f. Distribute fertilizer uniformly over areas to be seeded at the rate specified in Table 1 of this section.

(1) Use suitable distributor.

(2) Incorporate fertilizer into soil to depth of a least two (2) inches.

(3) Remove stones or other substances which will interfere with turf development or subsequent mowing.

g. Grade seeded areas to smooth, even surface with loose, uniformly fine texture.

(1) Roll and rake, remove ridges and fill depressions, as required to meet finish grades.

(2) Fine grade just prior to planting.

3. Seeding:

a. Use approved mechanical power driven drills or seeders, mechanical hand seeders, or other approved equipment.

b. Distribute seed evenly over entire area at the rate specified in Table 1 of this section.

TABLE 1: SEEDING SCHEDULE

MATERIAL	SEED TYPE	MINIMUM SEED PURITY (%)	APPLICATION RATE[1]
Lime	-----	-----	-----
Fertilizer	-----	-----	-----
Seed	Kentucky 51 Tall Fescue Sericea Lespedeza[3] Kobe Lespedeza Pensacola Bahiagrass Seasonal Nurse Crop[2]	97 97 97 97 97	80 lbs/acre 20 lbs/acre 10 lbs/acre 30 lbs/acre See Note 2)
Mulch	-----	-----	4,000 - 5,000 lbs/acre
Binder	-----	-----	150 gallons/acre

Notes:

1. Application rates and/or chemical analysis shall be confirmed or established by a soil test.

2. Use seasonal nurse crop in accordance with seeding dates as stated below:

   May 1 - August 31: 10 lbs/acre German Millet or 15 lbs/acre Sudangrass
   August 15 - May 1: 40 lbs/acre Rye (Grain).

3. From September 1 - March 1, use unscarified Sericea seed.

4. In the event of no soil test, 4,000 lbs/acre of lime shall be applied and 1,000 lbs/acre of fertilizer shall be applied.

END OF SECTION

SECTION 03310

CONCRETE WORK

Concrete Work: Concrete will be used in concrete structures.

A. DESCRIPTION

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of all concrete including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Erosion and Sedimentation Control	02270
Storm Water Systems	02720

3. Reference Standards:

The latest revision of the following standards of the American Concrete Institute (ACI) and the American Society for Testing and Materials (ASTM) are hereby made a part of these specifications:

ACI 301	Specifications for Structural Concrete for Buildings.
ASTM C 31	Standard Method of Making and Curing Concrete Test Specimens in the Field.
ASTM C 39	Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C 94	Standard Specification for Ready Mixed Concrete.
ASTM C 143	Standard Method of Test for Slump of Portland Cement Concrete.

welded wire fabric in place. Use wire bar type supports complying with CRSI specifications, unless otherwise acceptable.

(1) For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

(2) For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

C. SUBMITTALS

1. The Contractor shall submit concrete mix designs to the Engineer for approval at least 15 days prior to the first concrete placement.

2. Shop Drawings:

Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.

D. CONSTRUCTION

1. Concrete shall be placed per the procedures specified in ACI 301.

2. Placing Reinforcement:

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

a. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

b. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

c. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

b. Test results will be reported in writing to the Engineer and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7 day tests and 28 day tests.

c. Additional Tests: The CQA Engineer will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Engineer. The testing service, may conduct tests to determine the adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. The Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

Appendix C

Erosion and Sedimentation Control Plans and Details
(Drawings are Provided as an Attachment H to this Application)

Correspondence

G.N. RICHARDSON & ASSOCIATES
Engineering and Geological Services

June 2, 2006

Mr. John Holley, P.E., CPESC.
Regional Engineer
North Carolina Division of Environment and Natural Resources
Land Quality Section (Courier 52-01-00)
3800 Barrett Drive
Raleigh, NC 27609

Re: Erosion and Sedimentation Control Plan
42 East, LLC
Flowers LCID Recycling Center

Dear Mr. Holley:

On behalf of 42 East, LLC, G.N. Richardson & Associates, Inc. (GNRA) would like to submit for your review, two (2) copies of the subject application. The site is located off of S.R. 1704 (Motorcycle Road Drive) near Highway 42 in Flowers, North Carolina. The total disturbed acreage is sixteen (16) acres. Please find the required $800 review fee ($50 per acre or portion thereof) for this acreage and then required financial responsibility ownership (FR/O) from attached. The contact person for 42 East, LLC is as follows:

42 East, LLC
Attn: Gary Lynch
3945 Powhatan Road
Clayton, NC 27520
Phone: (910) 423-4122

All planned construction is anticipated to begin in July of 2006 and/or following approval of the E&SC Plan by NCDENR. Please contact us at your earliest convenience with any questions or comments which you may have.

Should you have any questions or require clarification, please contact us at your earliest convenience.

Sincerely,
G.N. Richardson & Associates, Inc.

Kinjal B. Shah
Staff Engineer

Stacey A. Smith, P.E.
Project Manager

Enclosure

Cc: Gary Lynch, 42 East, LLC
File

G.N. RICHARDSON & ASSOCIATES
Engineering and Geological Services

June 16, 2006

Ms. Jennifer Willis
Environmental Protection Administrator
Johnston County Department of Utilities
P.O. Box 2263
Smithfield, North Carolina 27577

Re: Stormwater Management Plan
42 East, LLC
Flowers LCID Recycling Center

Dear Ms. Willis:

On behalf of 42 East, LLC, G.N. Richardson & Associates, Inc. (GNRA) would like to submit for your review, two (2) copies of the subject application. The site is located off of S.R. 1704 (Motorcycle Road Drive) near Highway 42 in Flowers, North Carolina. Review the site location map (attached). The total disturbed acreage is sixteen (16) acres. Please find the required $1200 review fee ($75 per acre or portion thereof). The contact person for 42 East, LLC is as follows:

42 East, LLC
Attn: Gary Lynch
3945 Powhatan Road
Clayton, NC 27520
Phone: (919) 427-7674

All planned construction is anticipated to begin in August of 2006 and/or following approval of the Stormwater Plan by Johnston County. Please contact us at your earliest convenience with any questions or comments which you may have.

Should you have any questions or require clarification, please contact us at your earliest convenience.

Sincerely,
G.N. Richardson & Associates, Inc.

Kinjal B. Shah
Staff Engineer

Stacey A. Smith, P.E.
Project Manager

Enclosure

Cc: Gary Lynch, 42 East, LLC
File

G.N. RICHARDSON & ASSOCIATES
Engineering and Geological Services

June 20, 2006

Ms. Karyn Pageau
NCDENR - Land Quality Section
3800 Barrett Drive
Raleigh, NC 27609

Re: Response to Comments
42 East, LLC
Flowers LCID Recycling Center

Dear Ms. Pageau:

On behalf of 42 East, LLC, G.N. Richardson & Associates, Inc. (GNRA) has prepared this response to the comments issued in correspondence dated June 16, 2006 (copy attached). The following responses address each comment and reference any revisions to the application previously submitted on June 8, 2006. Please find each comment in italicize and the associated response below.

Comment No. 1

Is proposed culvert passing stream flow? Are land disturbing activity and borrow / waste disturbing activity being conducted by this same person?

Response No. 1

Yes, the proposed culvert replacement will pass stream flow (Intermittent). A request is being filed by 42 East, LLC for a 401 Certification for a pipe to pipe replacement at this crossing.

Comment No. 2

Provide calculations for the swales to be installed.

Response No. 2

Swales/channels have been analyzed by HydroCAD as a part of Erosion and Sedimentation Control Plan. However, please find the attached analysis of each drainage channel which demonstrates that the proposed grass lining should perform acceptably. Additionally check dams will be installed along each channel **(Attachment A).**

Comment No. 3

Provide anti-flotation / buoyancy calculations for the proposed sediment basins.

Response No. 3

These calculations were performed during design but were inadvertently missed during submission. Therefore Anti-Flotation / buoyancy calculations have been provided in **Attachment B.**

Comment No. 4

Provide stabilization timetable such as "Disturbed areas left inactive between any phase of grading shall be temporarily seeded within 15 working days or 30 calender days, whichever is shorter. Provisions for permanent groundcover must be accomplished on exposed slopes 21 calendar days, and in remaining areas within 15 working days or 90 calender days, whichever is shorter".

Response No. 4

Specification 02270 has been revised to add the stabilization timetable for temporary and permanent ground cover (Paragraph B.10). Please find the attached specification **(Attachment : C).**

Furthermore, the stabilization timetable has been added to schedule for implementation on page 5 of the Erosion and Sedimentation Plan. A revised page is included in **Attachment: C**.

Comment No. 5

Provide additional inlet protection at culverts.

Response No. 5

The proposed remedial development will not include any disturbance upstream of the culvert. Therefore, inlet protection was not considered necessary.

Comment No. 6

Revise construction detail to show that minimum 4 - in diameter wood posts can be used for silt fence.

Response No. 6

Construction Detail (1/ EC2) for silt fence has been revised to reflect a minimum of 4 - in diameter wood posts. A revised drawing EC2 has been provided in **Attachment D**.

Comment No. 7

Provide maintenance requirements of all measures.

Response No. 7

The following paragraph for maintenance requirements of all measures has been revised in Specification 02270, Erosion and Sedimentation Control Plan, Section D : Construction, Item No. 2. "Maintenance of Erosion Control Devices" as follows:

c. Maintenance shall include, but not be limited to:

(1) The removal and satisfactory disposal of trapped sediments from basins or silt barriers shall be formed when at ½ capacity.

Addition:

Basin Dewatering

After further review of the plan, the number of dewatering holes and the cleanout elevation in the basins were revised (**Attachment B**) as follows:

Basin No.	No. of dewatering Holes	Cleanout Elevation
A	57	233.2'
B	43	242.2'

Should you have any questions or require clarification, please contact us at your earliest convenience.

Sincerely,
G.N. Richardson & Associates, Inc.

6/20/06

Kinjal B. Shah
Staff Engineer

Pieter K. Scheer, P.E.
Senior Engineer

NORTH CAROLINA PROFESSIONAL SEAL 021666 ENGINEER PIETER K. SCHEER 6/20/06

Attachments

Cc: Gary Lynch, 42 East, LLC
Johnston County Stormwater Administration
File

G.N. RICHARDSON & ASSOCIATES
Engineering and Geological Services

June 30, 2006

Ms. Karyn Pageau
NCDENR - Land Quality Section
3800 Barrett Drive
Raleigh, NC 27609

Re: Flowers LCID Recycling Center - Modification
42 East, LLC
Johnston County, North Carolina

Dear Ms. Pageau:

On behalf of 42 East, LLC, G.N. Richardson & Associates, Inc. (GNRA) is submitting the attached revision to the Erosion and Sedimentation Control Plan (E&SCP) for the above referenced site. The plan was originally submitted to the Land Quality Section on June 2, 2006.

The plan originally proposed to replace the existing 6" pipe with a 24" RCP culvert near the stream crossing. However, in this modification, we will not replace the existing 6" Pipe due to delays in DWQ. It is our understanding that any additional delays in submission to DWQ review would also delay the entire project. Therefore, we have removed this element. A revised Drawing No. S1 has been attached.

Should you have any questions or require clarification, please contact us at your earliest convenience.

Sincerely,
G.N. Richardson & Associates, Inc.

Kinjal B. Shah, E.I.
Staff Engineer

Stacey A. Smith, P.E.
Senior Engineer

Attachments

Cc: Gary Lynch, 42 East, LLC
Johnston County Stormwater Administrator
File