JOYCE ENGINEERING, INC.

Waste Industry Experts

Henderson Building
Suite 203
2301 W Meadowview Rd
Greensboro, NC 27407

tel: 336/323-0092
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www.JoyceEngineering.com

April 22, 2003

APR 2003
Received
Solid Waste
Section

Ms. Ellen Lorscheider
Permitting Hydrogeologist
Solid Waste Section
Department of Environment and Natural Resources
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Re: Material Recovery, LLC Brown-Field Road Proposed C&D Landfill
Site Application Hydrogeologic Report and Groundwater Monitoring Plan
Response to April 15, 2003 Comments
JEI Project No. 622.00, Task 01

Dear Ellen:

The purpose of this letter is to provide responses to the comments regarding the Hydrogeologic Report and Groundwater Monitoring Plan for the referenced application that were outlined in your phone conversation with Dan Moore on April 15, 2003. This letter and the associated attachments are provided in a format that allows for incorporation into the original report binder. These comments were concerning the need for an additional surface water monitoring point in the small tributary north of the northern disposal area. Surface water monitoring point SW-3 has been added in order to address these concerns. Both Drawing No. 9, which shows the Groundwater Monitoring Plan, and the corresponding text have been modified to reflect these changes. Please call me if you have any further questions.

Sincerely,
JOYCE ENGINEERING, INC.

NORTH CAROLINA LICENSED 1611 RACHEL P. KIRKMAN

Rachel P. Kirkman
4-22-03
Rachel P. Kirkman, P.G.
Project Hydrogeologist

Attachments

C: Norbert Hector – Material Recovery, LLC
Daniel R. Moore, P.G. – MRR Southern, LLC
Jim Barber – NC DENR Solid Waste Section
File

S:\Projects\Material Recovery LLC\Project 47901 Wake County Brownfield Rd\Task 03 Response to NCDENR Comments\Hydro response\Response to Comments 2.doc

All borings (B-1 through B-18) were abandoned by back-filling cuttings into the boreholes immediately following drilling. All rock core locations (C-1 through C-5) were abandoned by injecting grout via a tremie-pipe to the bottom of the borehole. None of these borings or core locations encountered the water table. These activities are summarized on Table 14 and abandonment forms for all rock core locations are located in Appendix 12.

4.4 Surface Water Monitoring

Three surface water monitoring points are proposed for the facility as shown on Drawing No. 9. Each surface water sampling location will be marked with a metal fence post located on the stream bank normal to the sampling location.

Surface water point SW-1 is located to monitor water quality in the major tributary, as it crosses into the site. The sample location is at the property line, just upstream of the junction of the smaller tributary that originates on site, south of the southern area. Surface water monitoring point SW-2 will serve as a downstream monitoring point. Samples from this point will be collected at a location approximately 400 feet northwest of the northern disposal area near the northern property boundary. Surface water monitoring point SW-3 will monitor the smaller tributary just north of the northern disposal area, which flows into the aforementioned major tributary. This location will serve as an additional downstream monitoring point for the northern disposal area.

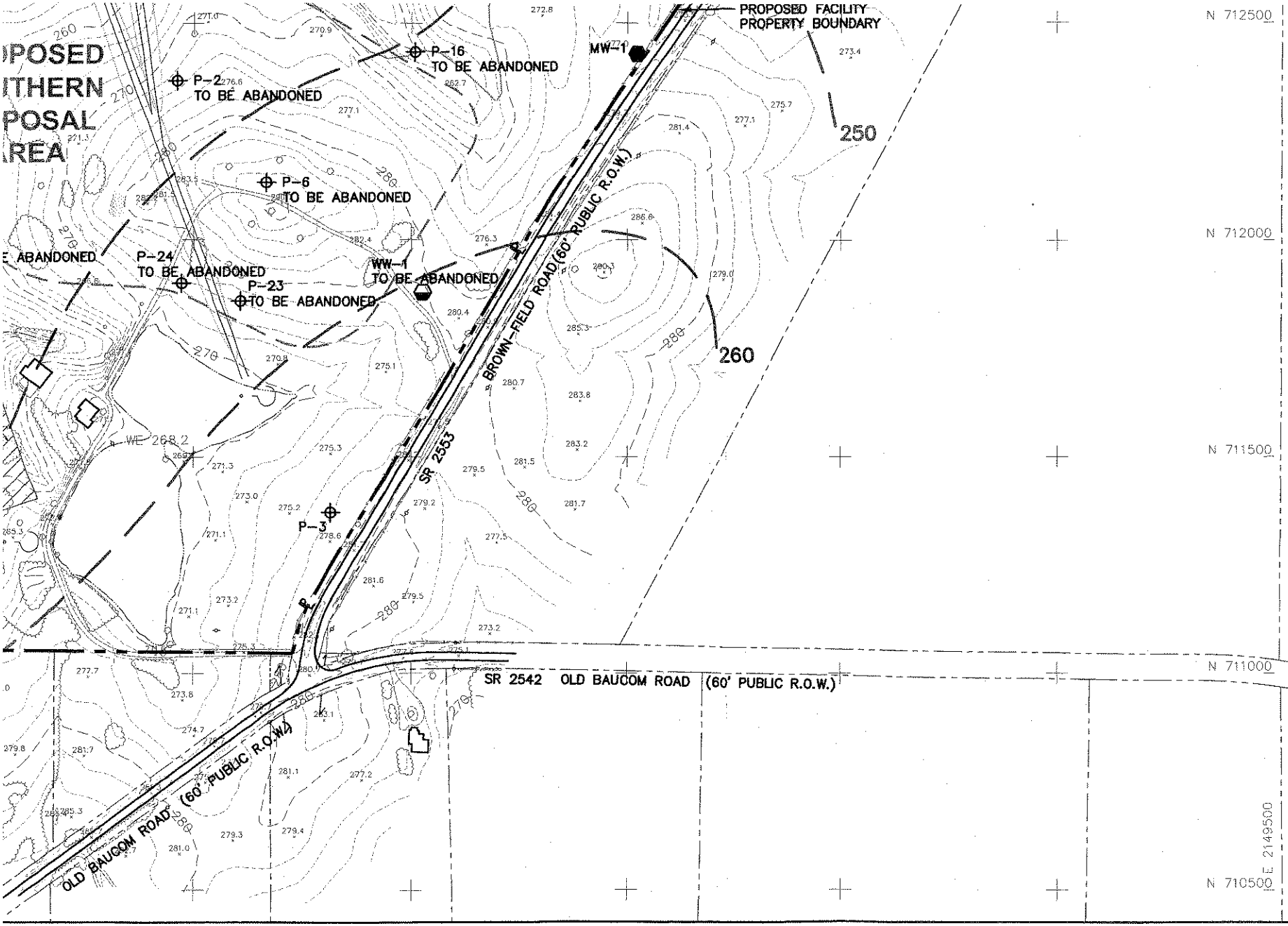
The surface water will be sampled for the constituents as outlined above that are required for C&D landfills and the locations will be monitored at least semiannually during the life of the facility. The results of the analysis of the surface water data will be submitted to the Solid Waste Section semiannually with the groundwater data.

4.5 Ability to Effectively Monitor Releases from Proposed C&D Areas

No known or potential sources of significant contamination have been identified within 2000 feet of the property boundary. Groundwater flow from this area is primarily to the northwest, with other components of flow to the west and north into minor drainages. There are no known conditions, physical or hydrogeologic, which will interfere with the effective monitoring of the proposed C&D cells.

Prior use of this land has generally been for agricultural purposes, although the City of Raleigh used a portion of the proposed northern disposal area for land application of sludge from the nearby Neuse River Waste Water Treatment Plant for approximately ten years, as discussed in Section 3.1 of this report. There is no reason to believe that the presence of sludge fields would adversely affect the siting of a landfill on this property. However, given the past history of land use on the northern portion of the property, several piezometers within the area that had been used for this purpose will be sampled for metals in order to establish background levels that may be elevated in this area.

Copied from drawing

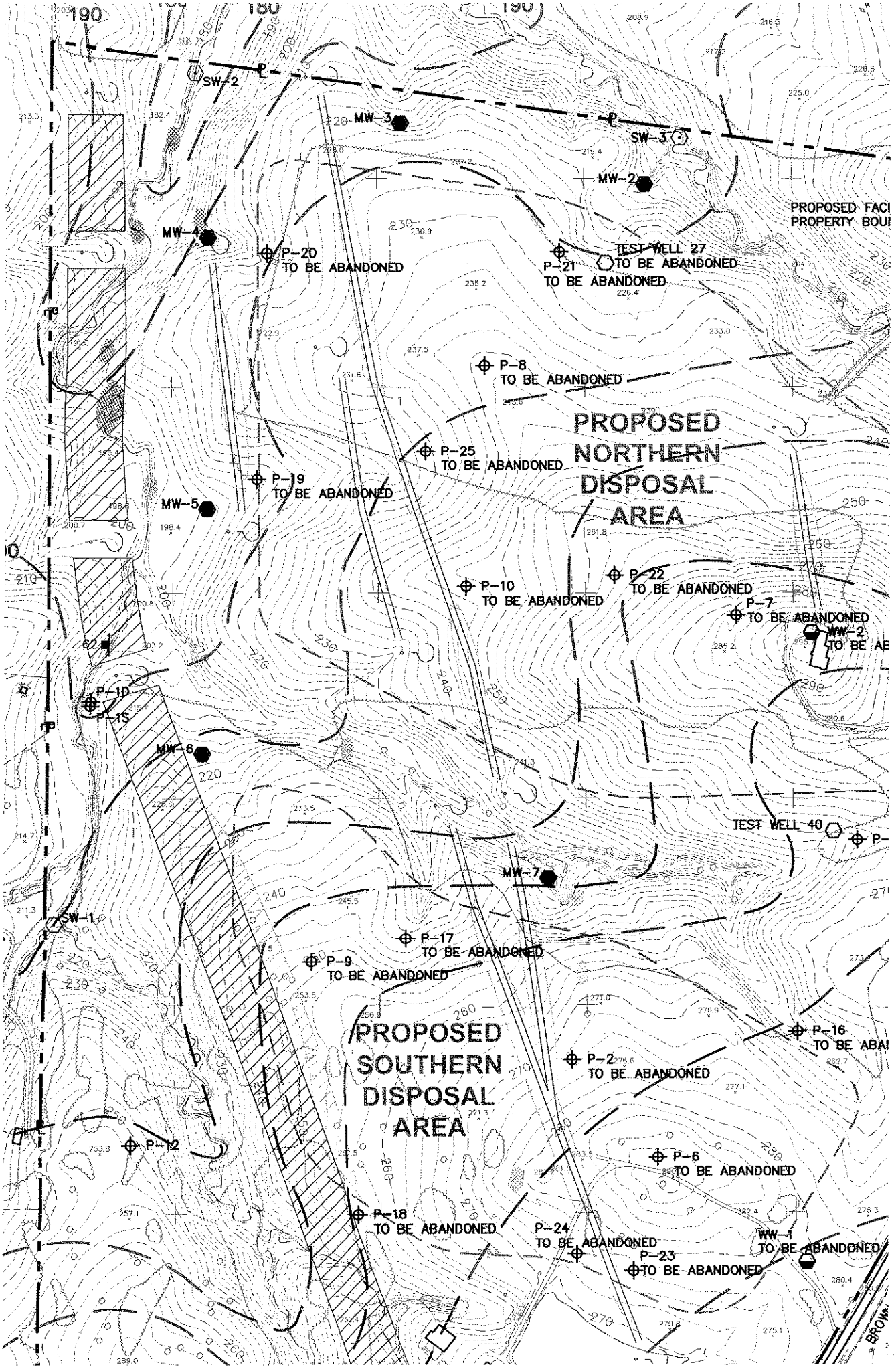


ENGINEERING, INC.
2301 W. MEADOWVIEW RD.
GREENSBORO, N.C.

MATERIAL RECOVERY, LLC
WAKE COUNTY, NORTH CAROLINA

PROPOSED MONITORING PLAN

DRAWING NO. 9



copied from drawing

NOTES:

1. MONITORING WELLS MW-4, MW-6 AND MW-7 TO BE FIELD LOCATED ON EAST SIDE OF DIABASE.

2. STATIC WATER LEVELS FOR ALL PIEZOMETERS AND CITY OF RALEIGH MONITORING WELLS MEASURED ON 10/03/01. SUPPLEMENTAL DATA FOR CONSTRUCTION OF GROUNDWATER CONTOURS TAKEN FROM TEST PITS ON 08/28-30/01, BORINGS B-1 THROUGH B-15 ON 10/01-02/01, AND CORE LOCATIONS C-1 THROUGH C-5 AND BORINGS B-16 THROUGH B-18 MEASURED ON 11/13-15/01.

3. GEOPHYSICAL ANOMOLIES AND DIKE INTERPRETATIONS TAKEN FROM GEOPHYSICAL INVESTIGATION REPORT BY PYRAMID ENVIRONMENTAL, INC. (IN APPENDIX 2).

4. THE LOCATIONS OF TEST PITS, BORINGS, CORE LOCATIONS, AND WELL 28B ARE APPROXIMATE.

5. THE COORDINATES FOR ALL "WELLS" AND "TEST WELLS" WERE TAKEN FROM WATER RESOURCES RESEARCH INSTITUTE SPECIAL REPORT SERIES NO. 20 (JANUARY 2000). HOWEVER, THE GIVEN LOCATION FOR WELL 28B DID NOT MATCH THE FIELD LOCATION AND THE PLOTTED WELL LOCATION WAS MOVED TO THE APPROPRIATE APPROXIMATE LOCATION.

LEGEND:

MAJOR ANOMOLY

MINOR ANOMOLY

MAJOR DIKE (ASSUMED BASED ON GEOPHYSICS)

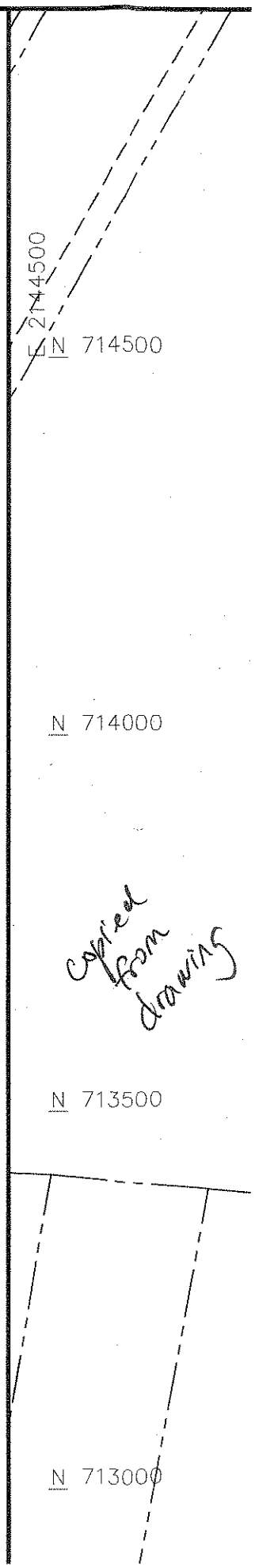
MINOR DIKE (ASSUMED BASED ON GEOPHYSICS)

NO GEOPHYSICAL DATA/DATA UNCLEAR ?

DIABASE OUTCROP

GRANITE OUTCROP

STRIKE AND DIP OF JOINT SETS 62



copied from drawing

Daniel R. Moore, P.G.
MRR Southern, LLC
2005 Rolling Road
Greensboro, NC 27403
P: 336 230 0896
F: 336 378 1945
M: 336 253 0091

MRR SOUTHERN, LLC

Fax

To: Ellen Worscheider **From:** DAN MOORE

Fax: 919.733.4810 **Pages:** 12

Phone: **Date:** 9-26-03

Re: Wake - Brown Field Rd C&D **CC:** Rachel Kirkman (JEI)

☐ Urgent ☑ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

• **Comments:**

Ellen:

I will call to discuss the attached documents. The first attachment is a letter prepared by R. Kirkman concerning final revisions to the Groundwater mon Plan. You will note that I was incorrect in my recent 9-12-03 letter to you about the no. of surface water mon points. There should be three not two as I noted. The P-to Construct suggests four.

The second attachment is the Soil Mgmt Plan submitted in April 2005. I have copied the relevant portion of the ~~Plan~~ drawing showing the soil stockpile area. Please let me know if I need to send another copy of this.

Thanks.

Dan

MRR Southern, LLC

2005 Rolling Road
Greensboro, NC 27403
Phone (336) 230-0896 Fax (336) 378-1945

SEP 2003
Received
Solid Waste
Section

September 12, 2003

Ms. Ellen B. Lorscheider, Hydrogeologist
DENR-Division of Waste Management
Solid Waste Section
1646 Mail Service Center
Raleigh, NC 27699-1646

RE: Post Construction Hydrogeologic Inspection/Certification-Phase 1, Cell A; Well Abandonment Certification (P-5, Well-28, -28A, -28B, & -28C); and Permit to Construct Clarifications Related to Groundwater Monitoring Material Recovery, LLC C&D Landfill, Wake County Permit No. 92-31

Dear Ellen:

The purpose of this letter is to provide written documentation and certifications related to inspection of the referenced facility's constructed subgrade for Phase 1-Cell A; and to provide records associated with additional well abandonment activities which have taken place at the site. Additionally, I would like to draw your attention to two permit conditions which need clarification in the *Monitoring and Reporting Requirements* stated facility's Permit to Construct. These issues are discussed in the final paragraph of this letter.

Hydrogeologic Subgrade Inspection: Pre-Operational Condition 8.e. of our Permit to Construct dated January 31, 2003, states that the following must take place prior to issuance of a Permit to Operate: "*Inspection and certification of the Phase 1 subgrade, by the project Hydrogeologist, to determine if subgrade conditions are consistent with the observations made during the initial site investigations and information provided in the site hydrogeology.*" As you are aware, on September 4, 2003, you and I conducted an inspection of the Phase 1, Cell A subgrade area prior to the placement of C&D waste. Please accept this letter as my certification that the subgrade was well prepared and exhibited no unusual geologic conditions that would be judged to impact the long-term stability of the subsoils, or potential flow of vadose waters and/or groundwater.

Well Abandonment: Attached to this letter are abandonment records for five monitoring wells (designated P-5, Well-28, -28A, -28B, and -28C) located at the referenced facility. Rachel Kirkman of Joyce Engineering submitted abandonment records for several other wells at this site in a letter to your attention dated April 3, 2003. The additional abandonments discussed in this letter were necessary based on construction and grading activities which took place subsequent to the initial abandonments.

Please accept this letter as my certification of proper well abandonment as required by 15A NCAC 13B Rule .1623 § (b)(2)(I). Abandonment was performed in accordance with 15A NCAC 2C Rule .0113 § (a)(2). The abandonment activities were performed under my direction on July 7, 2003 by N.W. Poole Well and Pump Company, a NC Certified Drilling Contractor. As the referenced wells were located in areas outside of the proposed waste disposal footprint, abandonment consisted of grouting the well casing/riser pipe annulus, from bottom to top utilizing a tremie-pipe. The individual well abandonment records (DWQ form GW-30) for each well are provided as attachments to this letter.

Phase 1, Cell A on September 4, 2003

Permit Clarifications: In review of the *Monitoring and Reporting Requirements* associated with the Permit to Construct there are two conditions which need clarification. Condition No. 14.b should be clarified to be consistent with the approved Groundwater Monitoring Plan, indicating that wells MW-1 thru MW-5 shall be utilized as compliance wells for the northern disposal area. Wells MW-6 and MW-7 are to be added as compliance monitoring points following construction of the southern disposal area. These monitoring issues are discussed in section 4.2.1 (Background and Compliance Monitoring Wells) of the *Hydrogeologic Report and Groundwater Monitoring Plan-Volume 1-Section II.* Also, in this condition it is stated that there are four surface water monitoring points, SW-1 thru SW-4. In section 4.4 of the Plan referenced above, there are only two proposed surface water points, SW-1 and SW-2. The four surface points are also referenced in permit condition 14.h.

Please contact me by phone at 336-230-0896 or email danmoore@triad.rr.com if you have questions concerning this submittal.

Sincerely,
MRR Southern, LLC

NORTH CAROLINA
LICENSED
9-12-03
SEAL
1303
GEOLOGIST
DANIEL R. MOORE

Daniel R. Moore, P.G.
(NC License No. 1303)
Manager of Environmental Services

Attachment – Well Abandonment Forms

C: F. Norbert Hector, Jr., Managing Member
Chris Roof, General Manager
Wilbert Carter, Landfill Manager
Rachel P. Kirkman, P.G., Joyce Engineering, Inc.

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-3221

WELL ABANDONMENT RECORD

WELL CONTRACTOR N. W. Poole Well & Pump
WELL CONTRACTOR CERTIFICATION # 23133

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: Raleigh County Wake
2600 Brownfield Rd. Raleigh, N.C.
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: D. H. Griffin Const. Co.

4. ADDRESS: 421 Raleigh Blvd. Raleigh

5. TOPOGRAPHY: draw, slope, hilltop, valley, flat (circle one)

6. TOTAL DEPTH: 40' DIAMETER 2"

7. CASING REMOVED:

feet	diameter
N/A	

8. DISINFECTION: None
(Amount of 70% hypochlorite used:)

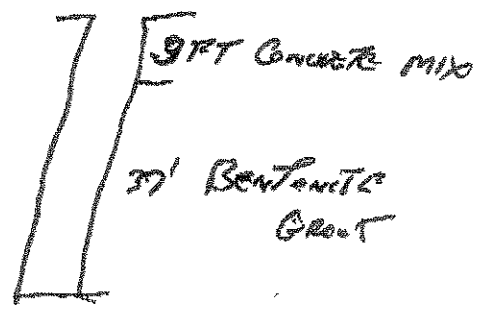
9. SEALING MATERIAL:
Neat Cement
bags of cement 1/2
gallons of water 4 GALS
Sand Cement
bags of cement
gallons of water
Other
Type material Bentonite mix
Amount 1 BAG

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL
Trim Grout

11. DATE WELL ABANDONED 7/7/03

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.

Well #1
(WELL NO. 28C)



I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well Timothy R. Rothwell Date 7-9-2003

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-3221

WELL ABANDONMENT RECORD

WELL CONTRACTOR N.W. Poole Well & Pump
WELL CONTRACTOR CERTIFICATION # 3133

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: ~~[illegible]~~ RALEIGH County WAKE
2600 DRAWNFIELD RD RALEIGH
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: Duke Griffin Const. Co.

4. ADDRESS: 421 RALEIGH VIEW RD. RALEIGH, NC

5. TOPOGRAPHY: draw, slope, hilltop, valley, flat (circle one)

6. TOTAL DEPTH: 40' DIAMETER 2"

7. CASING REMOVED:

feet	diameter
N/A	

8. DISINFECTION: None
(Amount of 70% hypochlorite used:)

9. SEALING MATERIAL:

Neat Cement
bags of cement 1/2
gallons of water 4 GAL

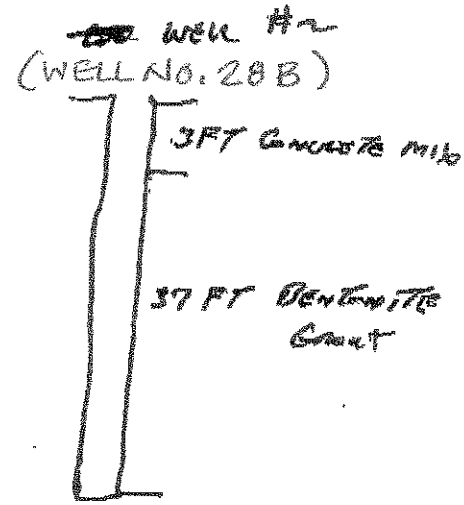
Sand Cement
bags of cement
gallons of water

Other
Type material BENTONITE MIX
Amount 1 BAG

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
TREM GROUT

11. DATE WELL ABANDONED 7/7/03

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well Timothy R. [illegible] Date 7-9-2003

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-3221

WELL ABANDONMENT RECORD

WELL CONTRACTOR N.W. Poole Well & Pump
WELL CONTRACTOR CERTIFICATION # 3133

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: RALEIGH
2600 BROWNFIELD Rd RALEIGH County WAKE
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: D.H. GRIFFIN CONST. CO

4. ADDRESS: 421 RALEIGH VIEW Rd. RALEIGH

5. TOPOGRAPHY: draw, slope, hilltop (circle one) valley, flat

6. TOTAL DEPTH: 40' DIAMETER 2"

7. CASING REMOVED:

feet	diameter
N/A	

8. DISINFECTION: NONE
(Amount of 70% hypochlorite used:)

9. SEALING MATERIAL:

Neat Cement
bags of cement 1/2
gallons of water 4 GALS

Sand Cement
bags of cement ____
gallons of water ____

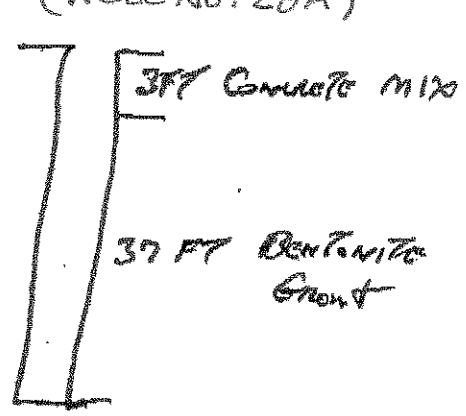
Other
Type material BENTONITE MIX
Amount 1 BAG

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
TRIM GROUT

11. DATE WELL ABANDONED 7/7/03

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.

WELL # 3
(WELL NO. 28A)



I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well Timothy R [signature] Date 7-9-2003

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-3221

WELL ABANDONMENT RECORD

WELL CONTRACTOR N. W. Poole Well Co
WELL CONTRACTOR CERTIFICATION # 3133

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: RALEIGH County WAKE
2600 BRONWFIELD Rd
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: D. H. Griffin Const Co.

4. ADDRESS: 401 Raleigh View Rd Raleigh

5. TOPOGRAPHY: draw, slope, (hilltop), valley, flat (circle one)

6. TOTAL DEPTH: 40' DIAMETER 2"

7. CASING REMOVED:
feet: N/A diameter:

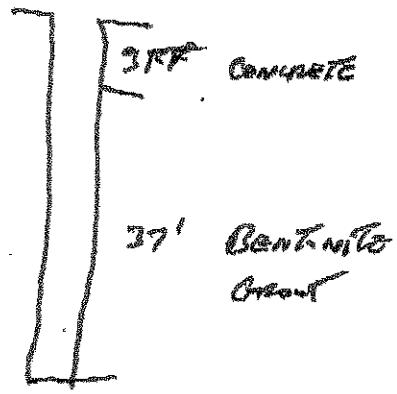
8. DISINFECTION: None
(Amount of 70% hypochlorite used:)

9. SEALING MATERIAL:
Neat Cement
bags of cement 1/2
gallons of water 40 gal.
Sand Cement
bags of cement
gallons of water
Other
Type material Bentonite Mix
Amount 1 Bag

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
Tremie Grout

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.

WELL #4
(WELL No. P-5)



11. DATE WELL ABANDONED 7/7/03

I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well Timothy R [illegible] Date 7-9-2003

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-1221

WELL ABANDONMENT RECORD

WELL CONTRACTOR N. W. Poole Well & Pump
WELL CONTRACTOR CERTIFICATION # 3133

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☒ Monitoring ☐ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: Raleigh County Wake
2600 Brainerfield Rd
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: D.H. Griffin

4. ADDRESS: 4W Raleigh View Rd Raleigh

5. TOPOGRAPHY: draw, slope, hilltop, valley, flat (circle one)

6. TOTAL DEPTH: 30' DIAMETER 6¼"

7. CASING REMOVED:
3' feet — diameter 6¼"

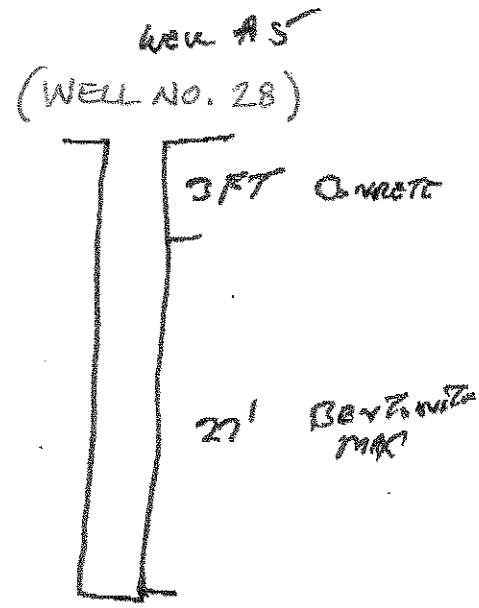
8. DISINFECTION: ½ gal.
(Amount of 70% hypochlorite used:)

9. SEALING MATERIAL:
Neat Cement
bags of cement 1
gallons of water 10
Sand Cement
bags of cement
gallons of water
Other
Type material Bentonite mix
Amount 3 gals.

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
Trim Grout

11. DATE WELL ABANDONED 7/7/03

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well Timothy R Rothwell Date 7-9-2003

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99

Subject: **Soil Management Plan-Brown Field Rd. C&D Site**
Date: Fri, 11 Apr 2003 10:00:03 -0400
From: "Dan Moore" <danmoore@triad.rr.com>
To: <Jim.Barber@ncmail.net>, <ellen.lorscheider@ncmail.net>
CC: <fnhector@dhgc.com>, <rkirkman@joyceengineering.com>

Jim & Ellen:

Attached for your review is the Soil Management Plan requested as Pre-Operational requirement no. 8h in the Permit to Construct for the referenced facility (Permit No. 92-31). Please let me know if you have any questions, comments or concerns. If this is acceptable I will forward a 'hard copy' and a transmittal letter for everyone's records. In the transmittal letter I will also address what appears to be a 'typo' in Operational Condition 14.b where two of the monitoring wells are referred to as "MW-? and MW-?." Also in Condition 14.b and 14.h there are references to four surface water monitoring points (SW-1 thru SW-4). In the Groundwater Monitoring Plan for the facility (Vol. 1, Sec. 2, Subsection 4.4 – Surface Water Monitoring) we proposed only two points, SW-1 and SW-2.

Thanks again for your help with this project. It's been a long road.

Also note my new contact info below. I can be reached at 336-253-0091 today.

Dan

Daniel R. Moore, P.G.

MRR Southern, LLC

danmoore@triad.rr.com

Ph: 336.230.0896

Fx: 336.378.1945

M: 336.253.0091

CORRECT w/ PTC