TO: Jim Bateson and Bobby Lutfy, NC DEHNR, Solid Waste Management Division

FROM: Richard R. Rust, PE, PhD, (919) 557-0444

DATE: 15 May 1995

SUBJECT: Draft Hydrogeologic Investigation and Ground-water Monitoring Plan for Permit Modification of Central Carolina Tire Monofill Permit Number 43-04

Fac/Perm/Co ID #	Date	Doc ID#
43-04	09119121	DIN 15780

REFERENCES:

Daniels, Ray, PG, SEC, Inc., Raleigh, NC; "Central Carolina Tire Monofill Piezometer Borings, Logs, and Ground-water Elevations", December 1994.

Aquaterra, Inc., Raleigh, NC; "Subsurface Investigation and Geotechnical Testing, Proposed Harnett County Monofill, Johnsonville, North Carolina", May 17,1991; located in NC DEHNR, Solid Waste Division File Room under permit No. 43-04.

Tribble & Richardson, Inc., Raleigh, NC; "Central Carolina Tire Monofill On-site Operations Manual", August 21, 1991; located in NC DEHNR, Solid Waste Division File Room under permit No. 43-04.

NC DEHNR, DEM; "15A NCAC 2C, Well Construction Standards, Criteria and Standards Applicable to Water Supply and Certain Other Wells"; current through December 1, 1992.

NC DEHNR, Solid Waste Division, "15A NCAC 13B Solid Waste Management Rules"; as amended through January 4,1993.

NC DEHNR, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities", March 1995.

Lutfy, Bobby, NC DEHNR; SWMD memorandum to Landfill Owners dated 24 June 1994 and further clarified in SWMD memorandum to Landfill Owners dated 18 January 1995.

BACKGROUND

In 1991 Central Carolina Tire Disposal submitted a tire monofill permit application to NC DEHNR, Solid Waste Management Division. 40.7 acres of the 311.0 acre property were specified and submitted for tire monofilling operations. Geologic, hydrogeologic, archaeologic, endangered species / habitat, and wetlands investigations were conducted on the 40.7 acres. Local land use and zoning for tire processing and disposal were obtained for the 311.0 acres. 1.7 acres of wetlands were delineated on the 40.7 acre site.

With the exception of wetlands, site acceptability was granted by NC DEHNR on the 40.7 acre site. Due to Corps of Engineer backlog, wetlands permit application review was not expected in a timely manner. Central Carolina Tire Disposal was obligated by contracts to receive tires prior to the anticipated issuance of the wetlands permit.

In order to expedite permit review and approval, Central Carolina Tire Disposal then opted to seek construction and operations permitting for the site in phases (specific geographic areas within the site). Of the 40.7 acres, 10.5 acres excluded wetlands and were permitted for tire monofill construction and operations under Permit No. 43-04 (dated 16 March 1992) as Phase I.

Central Carolina Tire Disposal now desires to permit the remainder of the 40.7 acre site (30.2 acres referred to as Phase II) described in the original permit application. On 14 March 1995, Jim Coffey with Jim Barber, NC DEHNR, decided that the permitting of Phase II would be conducted as modification to the existing permit.

In February 1991 Aquaterra conducted a geologic / hydrogeologic investigation of the 40.7 acre site. 11 borings were logged and piezometers were installed in 7 of those borings. This report exists in the NC DEHNR file room as part of Permit 43-04. 4 monitor wells were installed and sampled beginning in April 1992. 2 surface-water monitor points (down gradient seeps) were designated and sampled beginning at the same time. In December 1994, Ray Daniels, Geologist, SEC, Inc., logged and installed 7 additional piezometers in the Phase II area.

On 27 March 1995 Richard Rust, Engineer, met with Jim Bateson and Bobby Lutfy, NC DEHNR to discuss sufficiency of existing hydrogeologic data in establishing seasonal high ground-water. On 29 March 1995 Jim Bateson and Jim Barber, NC DEHNR visited the site with Tom Womble, Central Carolina Tire Disposal, and Richard Rust, Engineer, to investigate geologic, and topographic impacts on determining seasonal high ground-water. The conclusions of these meetings were:

1. The site exhibits characteristics typical of the Mittendorf formation. Intermittent discontinuous clay lenses are bedded in sandy silts. These near surface lenses perch local ground-water above the permanent ground-water table. The existence of thin intermittent discontinuous clay lenses was confirmed during excavation of Phase I.

2. Seeps (springs) exist as shown on the enclosed map downgradient from the monofill. The seeps are a result of clay lenses intersecting surface topography. The monofill (Phase I and II) is located on the east side of a ridge crest. The seeps are the origination of surface-water for the site (there is no up-gradient surface-water). The ridge

is the highest topography in the vicinity. There is no opportunity for recharge of the site's ground-water from areas other than the ridge. The seeps are therefore a prime location for sampling down-gradient ground-water quality.

3. Ground-water elevation variability will be determined by correlation of rainfall data to ground-water elevations recorded during previous sampling of the ground-water monitoring wells. Variability will be taken into account in establishing the limit of excavation to insure 4 foot of soil separation between bottom of excavation and seasonal high ground-water elevation.

Over the past 4 years the seeps have been observed periodically during and between sampling events. Surface-water Monitor Point No. 1 (SW-1) is adjacent to two of the seeps east of the Phase II area. None of the seeps have migrated up-gradient following periods of high precipitation (including the seep that feeds SW-2 in the Phase I area). Vegetation, soil erosion, and morphology at the seeps further show that the seeps remain stationary. This indicates that variations in high ground-water elevation on the eastern boundary (down-gradient side) of the monofill is minimal (less than 1 foot).

4. Ground-water contours may be adjusted between piezometric data points to reflect the shape of the surface topography.

GROUND-WATER ELEVATION SEASONAL VARIABILITY

Jamie Marlowe, USGS Raleigh, 571-4000, indicated on 10 May 1995 that USGS has operated 2 monitor wells with continuous water elevation recording devices for 3.5 half years at Fort Bragg. The wells are installed in the southern edge of the Mittendorf overlying the Cape Fear. The average depth to groundwater from surface elevation is 11 feet, with minimum and maximum recorded depths of 9 and 13 feet respectively. Maximum depths to water over the 2.5 year period of record (data for 1995 is not yet available) have occurred in late summer to early fall (August, September, and October). Minimum depths to water have consistently occurred in March.

An examination of five samplings conducted on ground-water monitor wells between April 1992 and December 1994 reveals maximum variances in ground-water elevation for each monitor well as follows:

MW - 1 (Upgradient)	MW - 2 (Downgradient, Phase I Area)	MW - 3 (Downgradient, Phase I Area)	MW - 4 (Downgradient, Phase I Area)
0.66 feet	1.64 feet	1.40 feet	0.08 feet

In correlating ground-water elevation to precipitation data from Pope AFB (8 miles SE of the monofill), the highest ground-water elevations were recorded on 4/14/94 following the median preceding 1, 2, and 3 months of rainfall. The lowest ground-water elevations were recorded on 12/20/94 following the lowest preceding 1, 2, and 3 months of rainfall. Median ground-water elevations resulted from sampling conducted following the highest preceding 1, 2, and 3 months of rainfall on 8/30/94 when evapotranspiration would have been highest. Therefore, there appears to be no firm correlation between long-term rainfall and ground-water elevation, which may be expected in measuring surficial ground-water perched on intermittent discontinuous clay lenses. Jamie Marlowe, USGS Raleigh, indicates one of the Ft. Bragg recording wells (mentioned above) is located in proximity to a recording stream elevation gaging station. Changes in ground-water elevation mirror changes in stream elevation within hours. This is in keeping with high conductivities associated with Mittendorf sands / silts.

Examination of 7 day piezometer readings conducted in February 1991 and December 1994 reveals variances as follows:

PZ - 1	PZ - 3	PZ - 4
0.25 Feet	1.62 Feet	2.08 Feet

In all three piezometers higher elevations were indicated in February of 1991. Precipitation for the preceding 1 and 3 months were almost identical for the two sampling events. However, for the preceding 2 months precipitation was higher for the February 1991 reading (4.93 inches) than the December 1994 reading (3.43 inches).

Due to the variability of the seasonal ground-water at the site, we will limit excavation to within 6 feet of the ground-water elevations shown on the enclosed plan in order to insure separation of waste from seasonal high ground-water of 4 feet.

MONITORING PLAN

The existing monitoring wells (MW's) and surface-water monitoring points as well as proposed additional MW's are illustrated on the attached drawing.

Existing monitoring wells are MW-1 (upgradient) and MW's -2, -3, -4 and surface-water monitoring points SW -1 and -2. MW-1 provides upgradient (background) samples for the entire monofill (Phase I and II). MW's -2, -3, -4 provide downgradient samples for Phase I.

Existing surface-water monitoring points SW -1 and -2 provide samples for the entire monofill (Phase I and II). Since the SW points are located in seeps, SW samples indicate both ground-water quality and surface-water quality. If contamination is detected, SW sample analysis results are to be compared to the MW samples, particularly samples from MW's in proximity to the SW's, to determine whether contamination is from runoff or leaching.

There is no upgradient SW point due to monofill being located adjacent to a ridge with no flowing water. The seeps are the origination of flowing surface-water on the site.

Two additional ground-water monitoring wells (MW's -5 and -6) will be installed to provide downgradient samples for Phase II.

Sampling of surface-water will coincide with semi-annual ground-water sampling as per NC DEHNR, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities", March 1995. Samples will be analyzed for Appendix I parameters as per Lutfy, Bobby, NC DEHNR; SWMD memorandum to Landfill Owners dated 24 June 1994 and further clarified in SWMD memorandum to Landfill Owners dated 18 January 1995.

Wells will be installed as per 15A NCAC 2C .0108 by a well driller registered as per 15A NCAC 2C .0103. Permits will be obtained for installation of wells as per 15A NCAC 2C .0105. If requested by NC DEHNR, DEM, samples of cuttings will be furnished as per 15A NCAC 2C .0114 (a). Wells will be developed as per 15A NCAC 2C .0108. Records will be filed as per 15A NCAC 2C .0114 (b).

The borings for monitoring well installation will be advanced by mechanically twisting a continuous-flight, steel auger into the soil. It is expected that the soils will be loose (cohesionless) sands and silts, which will readily cave in. Hollow stem auger will probably be used, and the wells will be constructed within the auger as it is removed. Wells will be logged by field classification of soils. Refusal to the soil-drilling equipment or very slow advancement because of subsurface materials that are more rock-like than soil-like will necessitate

use of other drilling methods to advance the borehole (dense or difficult subsurface materials are not anticipated). Rotary-wash drilling, rock coring using potable water and air-percussion/air-rotary drilling could be used for penetrating very dense soils or rock.

Type II monitoring wells will be constructed in boreholes at locations MW-5, and MW-6. The wells will consist of 2-inch diameter, Schedule 40 PVC pipe with flush-threaded joints. The bottom 15-ft section of the PVC pipe will consist of manufactured well screen with 0.010-inch wide openings.

The screened intervals for MW-5 and MW-6 are to start 1 foot above seasonal high ground-water elevation and to extend downward for a depth of 15 feet. Stable ground-water elevation is expected within several feet of the surface at both locations due to the proximity of the seeps.

The 2 inch PVC pipe is to protrude at least 1 foot above the surface topography.

Washed sand backfill will be placed around the outside of the screen and pipe to at least one foot above the top of the well screen and at least one foot below the bottom of the screen. The sand backfill is used to stabilize the formation and to help yield a less turbid ground-water sample. A bentonite seal (minimum 1-ft thick) will be installed on top of the sand backfill to seal the monitoring well at the desired level. The remainder of the borehole will be grouted to the ground surface, using the tremie method, with a Portland cement/bentonite mixture. A steel protective cover will then be placed over the well. The protective cover will be anchored with a concrete collar sloped at the surface to shed surface-water, thus reducing the potential for surface-water run-in. A metal data plate will be set in the concrete collar. The data plate will contain information related to the drilling contractor (name and registrations number), date completed, total and screen depths, and a warning that the well is not for water supply and that the ground-water may contain hazardous materials.

All downhole drilling equipment will be decontaminated by steam cleaning prior to drilling at each location to minimize the possibility of cross-contamination between wells.

Following installation, the new wells will be developed by evacuating water from them by bailing or pumping. The purpose of this work is to allow water from the formation to more freely enter the borehole. The techniques also tend to remove fines within the sand filter pack to enhance the possibility of sampling ground water relatively free of suspended solids.

Survey control of the new and existing wells will be established by a North Carolina Registered Land Surveyor. Horizontal control will be to the nearest 0.1-foot and vertical control to the nearest 0.01-foot.

Monitoring wells will be sampled on a semi-annual basis. Groundwater elevations will be recorded prior to purging and prior to taking a sample after recharge. Representative groundwater samples will be collected following purging of at least three times the volume of water within the wells or evacuating to dryness, whichever occurs first. The well will be allowed to recharge prior to sampling but not longer than 24 hours after purging.

The wells will be purged and sampled using clean disposable Teflon bailers and new polypropylene rope.

Use of field blanks and trip blanks will be part of each sampling event. The ground-water monitor well installation and sampling described herein is generally consistent with the 15A NCAC 2C .0108; NC DEHNR, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities", March 1995; and Lutfy, Bobby, NC DEHNR; SWMD memorandum to Landfill Owners dated 24 June 1994 and further clarified in SWMD memorandum to Landfill Owners dated 18 January 1995.

CHEMICAL ANALYSIS

Monitoring wells MW-1 through -6 and surface-water monitoring points SW-1 and -2 will be sampled on a semi-annual basis as per NC DEHNR, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities", March 1995, and the water will be tested for Appendix I parameters as per Bobby, NC DEHNR; SWMD memorandum to Landfill Owners dated 24 June 1994 and further clarified in SWMD memorandum to Landfill Owners dated 18 January 1995.

Analyses of surface-water samples and subsequent analyses of ground water will include one sample from each monitoring point and well. Water samples will be collected in laboratory-cleaned and laboratory-furnished containers, preserved as appropriate for the planned test method, and shipped for overnight delivery to the laboratory. Chain-of-custody protocol will be followed.

Copies of laboratory analysis reports will be furnished to NC DEHNR, Solid Waste Division, Groundwater Section, as soon as practicable.

S&EC
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To Whom It May Concern:

The information (boring logs, maps, etc.) in the attached package prepared for the Central Carolina Tire Monofill was prepared by Raymond Daniels, NC Licensed Geologist #949. His seal appears on each page of the boring logs. If you have questions regarding this information please contact us at the above address or phone number.

Carolina Tire Monofill

	Water To Top Casing	Casing Ht.	Top Water From Surface
MW-1	16'3"	2'	14'3"
PZ-1	12'3"	5"	11'10"
PZ-3	8'3"	3'2"	5'1"
PZ-4	15'5"	2'4"	13'1"
PZ-8	18'4"	4'9"	13'7"
PZ-9	Dry	3'5"	Dry
PZ-10	21'1"	4'2"	16'11"
PZ-11	10'	2'9"	7'3"
PZ-12	5'9"	5'5"	4"
PZ-13	6'5"	5'4"	1'1"
PZ-14	7'5.5"	4'4"	3'1.5"

READ 12/28/94

CENTRAL CAROLINA TIRE MONOFIL, PHASE 2

12/15/94

PZ8 Location: 30 feet NE from braced High Line pole north of MW1; Elevation about 373; slope 4%

Horizon	Inches	Description
A	0-9	10YR4/2-5/2 medium to coarse loamy sand; abrupt to
Bt	9-43	7.5YR5/6 medium to coarse sandy loam; weak fine subangular blocky structure gradual to
Bh?	43-47	7.5YR5/3 fine to very fine sandy loam; abrupt to
	47-67	10YR7/2 clay with few medium to coarse redder streaks and mottles; abrupt to
	67-72	Variegated 10YR4/2 and 5/4 light sandy loam to loamy sand; abrupt to
	72-119	10YR6/6 medium to coarse light sandy loam with few fine medium mica flakes; grades downward at 96 inches to 10YR7/8 medium to coarse light sandy loam to loamy sand; at 106 inches has rare fine dark minerals; gradual to
	119-145	10YR7/6 and 7/3 medium to coarse loamy sand; rare mica; few fine dark minerals at 121 inches grades downward to 10YR7/2 to 7/3 medium to coarse sand to sandy loam with few dark minerals; few gravel 0.4 inches long; grades downward at 140 inches to 10YR8/2 medium to fine sand with few fine dark minerals and rare mica; abrupt to
	145-166	7.5YR7/4 to 5YR7/4 medium to coarse heavy loamy sand to light sandy loam; at 153 inches changes to 5YR7/8 medium to coarse light sandy loam; saturated at 150 inches; grades downward at 166 to 10YR8/8; abrupt to
	166+	10YR7/1 clay; firm; not sticky; base of hole at 192 inches

Notes: set tip of screen at 15' below surface; packed surface sand around pipe; 20 feet 4 inches of casing.

Temporary water perching at 67-72 inches

Horizons = soil horizons in the upper part of the section. The depths without a horizon designation are descriptions of sediments. 10YR and other designations are Munsell soil colors, based upon the Munsell charts.

R. B. Daniels

12/15/94

PZ9 Location: 150 feet due east of pole 7210-106; slope 1-2 %; on spur ridge off main high ground; elevation about 363 feet; close to shoulder slope

A	0-7	10YR4/2 medium sandy loam; abrupt to
B	7-74	10YR7/3 to 7/4 clay to clay loam with common medium 10YR7/2 mottles and streaks; grades downward below 16 inches to 10YR7/2 clay with common 10YR7/4 and 7.5YR5/6 mottles and streaks; below 22 inches has 2.5YR/5/6 streaks; dry; tough; gradual to
	74-110	10YR7/2 medium to coarse sandy loam with common medium 7.5YR6/6 mottles and bodies; few fine gravel; partially cemented, few 1/4 inch iron nodules at 100 inches; clear to
	110-130	10YR7/2 sandy clay loam with few to common 7.5YR6/6 streaks and mottles; has few coarse sand grains; dense and relatively dry; gradual to
	130-190	10YR7/2 medium to coarse sandy loam with few fine gravel; dry and relatively dense but becoming more moist and friable with depth; common medium to coarse 7.5YR6/6 mottles and streaks; has alternating beds of fine and coarse sandy; 7.5YR6/6 mottles increase in size with depth; band of manganese and iron stains (purple) at 186-190 inches; abrupt to
	190-196	More yellow than 10YR7/8 fine sandy loam; few manganese stains; abrupt to
	196-202	10YR 7/2 clay; tough; dense; base of hole 202 inches

Comments: Set casing to 202 inches; 20 feet 4 inches of casing

Seasonal high water table at 74 inches

R.B. Daniels

12-15-94

PZ10 Location: about 280 feet east of Mw1 on rounded nose slope; slope about 8 percent, east

A	0-6	10YR4/2-5/2 loamy sand; abrupt to
Bt	6-24	7.5YR6/6 sandy clay loam with common fine to medium ironstone nodules; grades downward to 10YR7/6 in lower 6 inches; gradual to
BC	24-40	10YR7/6 medium sandy loam; clear to
	40-83	10YR6/6 medium to coarse loamy sand; few to common medium to coarse mica flakes; abrupt to
	83-94	10YR5/3 sand; abrupt to
	94-122	10YR4/3 sand; has 6 to 10 inch thick alternating beds with 10YR5/3 sand; few ironstone pieces and common fine gravel; abrupt to 1/2 inch thick ironstone layer
	122-137	5YR7/3 medium to coarse sand; color probably from iron and manganese; abrupt to
	137-175	10YR6/2 dry, mealy medium sandy clay loam with medium to coarse sand; the sediment may be bedded coarse loamy sand and medium to fine clay loam; intermittent purple zones of coarse sand; abrupt to
	175-216	10YR6/2 dry mealy clay to coarse sandy clay; many purple streaks and bodies; few to common coarse mica in coarser parts of horizon; gradual to
	216-252	10YR7/2 medium to coarse sandy clay loam or clay loam; few to common medium to coarse mica flakes; moist, but not wet; becomes wet below 235 inches and grades to a medium sandy loam

Seasonal high water table at 137 inches.

R. B. Daniels

12-16-94 Cool and damp

PZ11 Footslope position at break to lower nearly level surface. Slope about 3 percent; Elevation about 331 feet

A	0-4	!0YR3/2 fine loamy sand; clear to
E1	4-14	10YR5/4 fine loamy sand; clear to
E2	14-21	10YR7/4-6/4 medium loamy sand; abrupt to
B	21-40	10YR5/6 and 7.5YR5/6 medium to coarse loamy sand; friable; gradual to
BC	40-58	7.5YR5/6 medium to coarse sandy loam to loamy sand with few to common fine gravel (<6mm); gradual to
	59-84	7.5YR5/6 to 10YR5/6 medium to coarse loamy sand; few to common fine gravel; few to common 7.5YR5/6 mottles; clear to
	84-116	10YR5/6 sandy loam with few to common fine gravel; more moist than above; grades downward below 105 inches to loamy sand with few fine gravel; saturated at 116 inches; gradual to
	116-141	10YR6/4 medium to coarse loamy sand with few fine gravel; hole closing ; abrupt to
	141+	10YR5/2 clay loam; base of hold at 143 inches;

Comments: Screen set to 143 inches

Seasonal high water table at 141 inches

R.B. Daniels

12-16-94

PZ12 Location: Next to dead pine in flood plain NE from PZ10

A	0-8	10YR2/1 very fine loamy sand to loam; Water table at 8 inches; Locally derived alluvium; clear to
B?	8-25	5Y3/1 clay loam with few to common medium 5Y5/3 and 4/3 mottles; clear to
	25-40	2.5Y6/2 medium to coarse sandy clay loam; grades downward to 2.5Y6/2 sandy clay to clay; medium to coarse sand; base of alluvium? Abrupt to
	40-47	10YR6/2 to 7/2 smooth clay; non sticky; relatively dry compared to sandier material above; unable to penetrate below 47 inches; hydraulic pressure of water stripped material from auger

Comments: Screen open from 39 inches to surface.

Seasonal high water table at surface

R. B. Daniels

12-16-94

PZ13 Location: Wetland delineation across from large plastic drain from phase 1 landfill. Site is about 50 to 60 feet west of drainage ditch

A	0-13	10YR2/1 fine sandy loam; mucky feel; locally derived alluvium; clear to
B?	13-30	5Y6/2 medium to coarse sandy clay loam with common 2.5Y6/4 and 6/8 mottles; saturated at 2 feet; clay content decreases with depth? Base of alluvium? gradual to
	30-65	10YR7/1 to 8/1 heavy sandy loam to light sandy clay loam; medium to coarse sand; below 35 inches has few medium to coarse 10YR7/4 mottles; grades downward at 64 inches to a 10YR7/8 medium to coarse sandy loam to loamy sand; base of hole at 66 inches

Comments: Unable to pull sediment below 66 inches; set 5' into ground; bottom of screen is 4 feet 4 inches below ground level

Seasonal high water table at surface

R. B. Daniels

12-16-94

PZ14 Location: About 60 north from gap in pines at preferred location of PZ14. Site is almost a footslope; slope about 3 percent.

A	0-5	10YR4/2 to 32 loamy sand; medium fine granular structure; clear to
E	5-18	10YR6/3 medium loamy sand; few medium 6/2 mottles; clear to
B1	18-30	2.5Y6/4 to 10YR6/4 medium to coarse sandy loam; few to common medium 10YR7/1 and 6/6 mottles; clear to
B2	30-49	10YR7/2 sandy clay loam with common medium 10YR7/6 mottles; below 43 inches grades to a sandy loam with sandy clay loam lenses and 5Y%6/6 mottles or bodies; abrupt to
	49-132	10YR6/1 clay loam to clay with medium to coarse sand and many medium to large 5YR6/6 mottles and streaks; grades downward below 55 inches to a medium to coarse sandy clay interbedded with sandy loam to sandy clay loam lenses; water in hole about 60 inches; Base of hole at 132 inches

Comments: 15 feet 4 inches of pipe is 54 inches above ground.

Perched? seasonal high water table at 30 inches

R. B. Daniels