

LG&E Power Development Inc.
3200 Park Center Drive, Suite 400
Costa Mesa, California 92626
714-241-4700
714-241-4791 FAX

December 20, 1996

Ms. Sherri Coghill
Environmental Engineer
State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Waste Management
512 N. Salisbury Street
P.O. Box 29535
Raleigh, North Carolina 27604

Subject: Additional Information for Ash Disposal
Petroleum Coke Test Burn
Roanoke Valley Energy Facility

Dear Ms. Coghill:

As you requested in your letter dated November 19, 1996 concerning the proposed petroleum coke test burn and the disposal of the mixed petroleum coke/coal ash generated, we are providing you with additional information. The information details the revised test schedule, the proposed methods for obtaining a representative sample for the mixed ash, the proposed methods for storing the test generated mixed ash on-site prior to disposal, and the analysis required for the different samples.

We have contacted Mr. Bill Hocutt from the Beneficial Reuse Section regarding the mixed ash being considered for beneficial reuse. We have obtained a specific test procedure from him for the petroleum coke test burn, which when followed, will provide him with pertinent data to determine the reuse possibilities of the mixed ash and prepare a guidance policy. Per our request, he prepared a test procedure for both fly ash and bottom ash for mixed ash that is generated from a coal/coke fuel blends of 15% and 20%.

SCHEDULE:

As you are aware from our telephone conversations, the petroleum coke test burn schedule has changed. Due to various reasons associated with this project, we have delayed the start and divided the test burn into three sections. This new schedule will allow for segmenting limited amounts of mixed ash to facilitate disposal.

The first testing section is scheduled for commencement on [REDACTED] for a three day period. This initial testing will be performed to determine the waste designation of

mixed ash generated at 5% and 10% fuel mixtures. The 5% fuel blend will be introduced into the boiler and after 24 hours, samples will be taken. We have estimated that it will take approximately 24 hours to stabilize the systems after initial burning of the each fuel mixture. The 10% fuel blend percentage will then be introduced into the boiler and burned for approximately 24 hours, then samples will be taken. After which, the test burn will then be stopped to allow time for the test results to be received and to determine the designation of the mixed ash for disposal purposes. During this waiting period the plant will burn only coal. After non-hazardous results are confirmed and the combined 5% and 10% generated ash is disposed, the mixed fuel test burn will resume.

The second section of the test burn will involve using the 15% and 20% mixed fuel blends, and should begin on January 14, 1997. The first fuel blend to be used will be 15%. As previously stated, it will take 24 hours to stabilize at this fuel percentage. Once the systems are stabilized at 15% mixed fuel, ash samples will be taken then analyzed. Then the plant will increase the fuel percentage to 20% petroleum coke. When the plant is stabilized at 20% mixed fuel (approximately 24 hours), mixed ash samples will be taken and then analyzed. The data obtained from the testing will provide the information needed to determine toxicity characteristics for disposal purposes. After the samples are taken, the plant will then return to burning 100% coal. It is anticipated that the coal only burning will begin on January 16, 1997. After non-hazardous results are confirmed, the combined 15% and 20% generated ash will be disposed, completing the second section of the mixed fuel test burn.

The third section of the test burn will involve the air emission testing and mixed ash testing for beneficial reuse purposes, which is anticipated to start the week of January 27, 1997. The plant will take approximately 24 hours to reach the 15% fuel blend. Once the plant is stabilized at a 15% mixed fuel blend, the air emission testing will commence and ash samples will be taken. The five samples will be taken over a 24 hour period and analyzed per the beneficial use test procedure. The fuel blend will then be increased to 20% and five samples will be taken following the same procedure previously stated. Based on the positive results of the 15% and 20% mixed ash performed during the second section of this test burn, the 15% and 20% mixed ash generated during this third section of the test will be transported to the Halifax County landfill for disposal. The results of the beneficial reuse testing will be submitted to the Solid Waste Section for review and determination for beneficial reuse purposes. The test burn should be completed by the end of February 1997, at which time all the on-site petroleum coke will be utilized. No modifications will be performed on the boiler or emission control equipment during the test burn.

REPRESENTATIVE SAMPLING:

The attached ash test protocol lists the ash samples to be taken at the petroleum coke/coal fuel percentages and for the desired purpose. Since the fly ash collection and handling system (which also combines the spent lime material from the FGD system) is separate from the bottom ash collection and handling system, separate samples will be taken for the two different ash types.

The ash generated from the 5% and 10% fuel mixtures will be tested for disposal purposes only, and the mixed ash generated from the 15% and 20% fuel mixtures will be tested first for disposal purposes (during the second test section) and then for beneficial reuse purposes (during the third test section.) The test procedure prepared by Mr. Bill Hocutt and provided to us for beneficial reuse has been incorporated into the attached ash test protocol and will be used accordingly.

To obtain a representative sample of the fly ash/spent lime, ash will be taken from two separate locations and then mixed together in the proper contributing percentages. In addition, the various mixed ash samples will be taken approximately 24 hour after petroleum coke introduction to ensure proper stabilization of the systems. This method of obtaining the sample is necessary to allow for a representative sample at the different percentage values since the mixed fly ash is to be directed to the silo for temporary storage. It will be difficult to distinguish between the varying percentage layers in the silo. The first sample location is the air heater hoppers, which collects the minor percentage of fly ash (approximately 2% of the total volume). The second location is the ash surge tank which collects fly ash directly from the baghouse and is the major source of fly ash (approximately 98% of the total volume). Based on these percentages, the fly ash/spent lime will be blended and analyzed.

Samples of the bottom ash will be taken directly from the trailer containers where the ash is stored. This mixed ash sample will have the same moisture content that will be delivered to the landfill. Taking this bottom ash sample will not vary from the normal procedure currently followed by the plant.

ANALYSIS:

As the samples of the fly ash/spent lime and the bottom ash are taken at the varying percentages, they will be immediately sent to the laboratory for analysis. The laboratory will be requested to provide test results in three days, this service is available for an added cost. One exception is for the organic TCLP tests, which will take four days to receive the results.

The mixed ash samples generated from 5%, 10%, 15% and 20% fuel mixtures will be tested for disposal purposes as noted on the attached protocol. This includes testing for the TCLP RCRA metals and pH. The ash generated during the test burn will have the same moisture content as the current or normal operating condition coal ash generated, and therefore, will not contain free liquids. Due to this, we are not intending to perform paint filter tests on the mixed ash samples. Per your request, one sample will be analyzed for TCLP organics (volatiles and semi-volatiles). This testing will utilize EPA methods 8240 and 8270. To expedite the determination of mixed ash toxic characteristics, the TCLP organic test will be analyzed for the ash generated with the 5% fuel mixture. If the TCLP test results from this 5% mixture indicate organics that are below the regulatory levels, no further organic testing will be performed on the mixed ash for disposal purposes.

If the presence of organics is observed in the test results, an additional TCLP organic test will be performed on the mixed ash generated from the 20% fuel mixture during the second section of the testing. Using these percentages will give a best and worst case scenario.

It should be noted, however, that a TCLP organic test is required per the beneficial reuse testing procedure prepared by Bill Hocutt. Due to this requirement, mixed ash generated at 15% and 20% fuel mixtures will be tested for TCPL organics in the third section of the test burn. This data will be confirming data for landfill disposal purposes and useful data for beneficial reuse determination.

Upon individual receipt of each of the test result packages from the laboratory during all three sections of the test burn, the data will be forwarded to the North Carolina Solid Waste Section as requested. The data will be provided immediately by fax and then followed by a written copy via overnight mail. In addition, the test results will also be faxed and then mailed to Halifax County. Concurrently, we will review and compare each test set with the regulatory levels to determine mixed ash waste designation. Due to the combined 5/10 percent storage of the mixed ash in the silo for the first section of the test burn and then the combined 15/20 percent storage in the silo for the second section of the test burn, the plant will await the results for fuel blends of 10% and 20% generated ash, respectively, prior to determining final regulatory compliance. Once assured the regulatory levels are met, designating the mixed ash as having a non-hazardous status, the mixed fly ash and mixed bottom ash will be delivered individually by truck during two separate trips to the Halifax County landfill for disposal.

STORAGE:

During the testing and while waiting for the TCLP test results to be received from the laboratory for disposal determination, the mixed ash will be stored on the Roanoke Valley Energy plant site in two different areas. The fly ash/spent lime will be stored in one of the two ash silos, designated as the "mixed ash" silo for the test burn. The capacity of this silo is 900 tons and can accommodate 8-days of ash generated from Unit II. This silo will easily accommodate the first section of the test using the 5% and 10% fuel mixtures, which is estimated to generate approximately 300 tons of combined 5%/10% fuel blend mixed ash. After disposal of this mixed ash, the silo will easily accommodate the ash generated from the second section of the test which will burn the 15% and 20% fuel mixtures. It is anticipated that this portion of the test will generate approximately 300 tons of mixed fly ash.

During the interim periods, waiting for the test results, Unit II will return to burning 100% coal. The ash generated during the first 24 hours will be stored in the "mixed ash" silo to ensure all petroleum coke residue throughout the systems is gone. During the remaining time, the ash will be stored in the "coal ash only" silo with the ash generated from Unit I. The daily schedule for emptying the "coal ash only" silo will be extended to ensure proper coal ash storage capacity for Unit I and the limited quantity from Unit II.

The bottom ash from Unit II is deposited into one of two trailer containers, which have a capacity of 23 tons. For Unit II, the containers fill up at a rate of 1 container every two days. The first section of the test burn (burning 5% and 10% fuel mixtures, three day storage) will generate approximately 10.5 tons of bottom ash. When one of the two bottom ash trailer containers is full, it will be replaced with an empty container and the full container trailer will be moved to the coal pile storage area and covered with a tarp for temporary storage. The second section of the test burn (burning 15% and 20% fuel mixtures, three day storage) will generate the same amount of bottom ash. The same storage procedure will be followed as previously discussed. Another trailer container will be used during the "coal only" burn while the plant awaits the test results. As with the fly ash, the "coal only" container trailer will be used after 24 hours to ensure the ash is generated from 100% coal fuel only. Disposal of the first container will occur upon receipt of the positive test results and prior to initiation of the second section of the test.

The bottom ash generated during the third section of the test period (15% and 20% fuel mixtures for beneficial reuse) will be stored in trailer containers, but disposed of to the landfill as necessary. Mixed ash designation will already be determined during the first two sections of the test burn. An estimated of 2000 tons of ash will be generated (over a three week period) using the 15% and 20% mixed fuel mixtures due to the 24 hour run time required for each percentage. Extra trailer containers available from the ash transport contractor will be obtained for use during the test burn if demonstrated to be necessary.

Current operating practices allows for the fly ash and bottom ash to be transported to the Halifax County landfill in separate trucks. After verification of the mixed ash having non-hazardous status for the first section (combined 5% and 10%) and the second section (combined 15% and 20%) of the test burn, the existing method to transport the ash to the landfill for disposal will be followed. The mixed ash generated during the third section of test burn, at 15% and 20% mixed fuel blends, will be transported and disposed of as necessary.

If for some reason there are any problems during the first and second test sections, whether equipment or unanticipated TCLP test results, the test burn will be stopped and Unit II will return to burning 100% coal. This coal fly ash will be stored in the "coal only" designated silo and the bottom ash will be stored in the "coal only" trailer container after the designated 24 hours. If there is a delay in receiving the test results, the mixed ash will remain in the designated silo until the results are obtained. The other "coal only" silo will be utilized and the unloading schedule will be extended. If the test results indicate values higher than the regulatory levels, the mixed ash will be retested. If the retest result also indicated toxic characteristics, a hazardous waste hauler would be contacted, along with a hazardous waste landfill, to transport and dispose of the mixed ash. The mixed ash would be removed from the silo and relocated in rented covered containers until all agreements/contracts were completed and truck disposal was arranged and provided. The filled, rented containers, along with the bottom ash trailer containers, would be stored

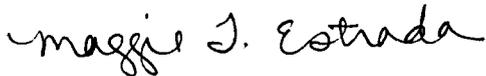
Ms. Sherri Coghill
NCDEHNR, Solid Waste Section

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either at the plant site, or on the Halifax County Property, depending on the quantity and/or necessary storage duration.

We believe this information should satisfy your request. We will keep you, Mr. Bill Hocutt, and Mr. Charles Archer of Halifax County informed regarding the status and schedule of this proposed project. Should you have any questions, do not hesitate to call me at (714) 241-4773.

Sincerely,



Maggie T. Estrada
Senior Environmental Engineer

Enclosure

cc: B. Hamilton
Q. Morrison
D. Ray
C. Archer, Halifax County
B. Hocutt, Beneficial Reuse
esd file/rvp.3.6

ASH TESTING PROTOCOL

December 20, 1996

- Mixed ash (coal and pet coke) samples are to be taken from Unit II at the various pet coke percentages:

<u>Fly Ash/Spent Lime</u>	<u>Bottom Ash</u>
5%	5%
10%	10%
15%	15%
20%	20%

Samples to be taken 24 hours after each percentage is introduced into boiler.

The results of the testing for disposal will also provide information to determine the continued use of bottom ash as daily cover at the landfill.

The mixed ash from Unit II ash silo containing fly ash/spent lime and the bottom ash will be delivered to the Halifax County landfill in separate trucks.

TESTING for DISPOSAL:

- Take two (2) samples each of fly ash/spent lime and bottom ash at 5% and 10% for disposal purposes. Fed Ex mixed ash samples to laboratory and ask for one (1) sample to be analyzed. Request 3 day turn around time. Perform the TCLP tests (RCRA metals) for the following constituents:

Arsenic
Barium
Cadmium
Chromium
Lead
Mercury
Selenium
Silver

In addition, analyze for:

Carbon
Nickel
Vanadium
pH
Sulfur

Use other sample as a back up.

- Take ~~two~~ ³ (2) samples of 5% fly ash and of 5% bottom ash. Fed Ex to laboratory. Request analysis of one (1) sample for TCLP test Organics (volatiles and semi-volatiles) on a 5%

2
Test analyzed?
back

mixed ash sample for disposal purposes. Request 4 day turn around time. If organics are not detected no further organic testing is required. If organics are detected, take two (2) samples of 20 % mixed ash, Fed Ex to laboratory and analyze one (1) sample for TCLP organics. Request 4 day turn around time.

TESTING for BENEFICIAL REUSE:

- Take five (5) samples of "coal only" ash and from Unit II under normal operating conditions. This to be performed prior to test burn for comparison purposes. Samples are to be taken over a 24 hr period, approximately every four (4) hours, starting 4 hours after stabilization (at least 24 hours after fuel mixture introduced into boiler). Analyze specific samples as noted in table.
- Take five (5) samples each of the fly ash and bottom ash at 15% mixed ash. Samples are to be taken over a 24 hr period, approximately every four (4) hours, starting 4 after stabilization (at least 24 hours after fuel mixture introduced into boiler). Analyze specific samples as noted in the table.
- Take five (5) samples each of the fly ash and bottom ash at 20% mixed ash. Samples are to be taken over a 24 hr period, approximately every four (4) hours, starting 4 after stabilization (at least 24 hours after fuel mixture introduced into boiler). Analyze specific samples as noted in the table.
- Take five (5) samples of "coal only" ash and from Unit II under normal operating conditions. This to be performed after test burn for comparison purposes. Samples are to be taken over a 24 hr period, approximately every four (4) hours, starting 4 hours after stabilization (at least 24 hours after fuel mixture introduced into boiler). Analyze specific samples as noted in table.
- Additionally, perform the following analysis on the fly ash mixtures:

Mixed ash at 15% pet coke

Carbon, Total
Nickel, Total
Vanadium, Total
Sulfur, Total

Mixed ash at 20% pet coke

Carbon, Total
Nickel, Total
Vanadium, Total
Sulfur, Total

Table 1
Beneficial Reuse Procedure

ANALYSIS REQUIRED	100% COAL BEFORE TEST	15% PETROLEUM COKE	20% PETROLEUM COKE	100% COAL AFTER TEST
	SAMPLE NUMBERS TO BE ANALYZED			
8240 Scan	1,3,5	1,3,5	1,3,5	1,3,5
8270 Scan	1,3,5	1,3,5	1,3,5	1,3,5
Totals, (Metals only*)	1,3,5	1,3,5	1,3,5	1,3,5
TCLP, (Metals only*)	1,5	1,5	1,5	1,5
Full TCLP (No herbicides or pesticides required)**	3***	3***	3***	3***

Notes:

*Analyses for Total (Metals only) must be a search for and quantification for any detected. The TCLP (Metals only) analyses must be for any metals detected in the Total (Metals only) search.

**The full TCLP analysis must be for the above detected Metals, the TCLP regulated organics (except for herbicides and pesticides) plus any additional organics which exhibit significant peaks in the 8240 and 8270 scans.

***If organics are detected either in running this TCLP or in conducting the 8240 or 8270 scans, then additional full TCLP analyses must be performed on samples 2 and 4, in conjunction with sample 3.

The detection levels utilized in the TCLP analyses must be the lowest practical reporting limits attainable by the analytical laboratory.

December 19, 1996

Ms. Sherri Coghill
Environmental Engineer
State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Waste Management
512 N. Salisbury Street
P. O. Box 29535
Raleigh, North Carolina 27604

Subject: Consideration of Bottom Ash for Landfill Daily Cover
Petroleum Coke Test Burn
Roanoke Valley Energy Facility

Dear Ms. Coghill:

For the petroleum coke test burn scheduled to begin in January 1997, the Roanoke Valley Energy Project has requested the North Carolina Solid Waste Section to consider the mixed ash generated during the test burn for disposal at the Halifax County landfill and for beneficial reuse purposes. In addition, we also request the Solid Waste Section to consider the mixed bottom ash for use as daily cover at the Halifax County landfill. Currently, the bottom ash generated from coal is being use as landfill daily cover per a previously granted approval. We are requesting a similar review and determination for the mixed bottom ash.

The TCLP test results will be submitted to the Solid Waste Section for review and determination of the mixed ash for disposal and beneficial reuse purposes. We believe the same results can be used for the daily cover review and determination also.

Should you have any questions or require additional information, do not hesitate to call me at (714) 241-4773.

Sincerely,



Maggie T. Estrada
Senior Environmental Engineer

cc: B. Hamilton
Q. Morrison
D. Ray
C. Archer, Halifax County
esd file/rvp.3.6

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

AL-04
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James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director



December 19, 1996

Ms. Maggie Estrada
LG&E POWER
3200 Park Center Drive, Suite 400
Costa Mesa, CA 92626

Subject: Revisions to December 11, 1996 Letter from W.R. Hocutt to Maggie Estrada on
Analysis Protocol for Pending Weldon, NC Fuel Blend Test Burn.

Dear Ms. Estrada:

The purpose of this letter is to make revisions to the NC DEHNR, Division of Waste Management (DWM) Beneficial Use sampling and analysis protocols as stated in my letter of 12/11/96. This is for the upcoming test burn of coal:petroleum coke (CPC) fuel blends at your Weldon, NC facility.

The discussion in the second paragraph of page one about the length of the test burn needs to be modified in two ways. First, the minimum duration of twenty four hours for the test burn is assuming a **stable operating period**. Should there be some initial instability in the boiler unit upon introduction of the CPC fuel blend, then the twenty four hour burn period begins with attainment of stable operation. Also, since it has been confirmed that you plan to test both a fifteen % blend level of CPC to coal and a twenty % blend level as well, there will be **two test burn periods** of twenty four hours duration each. These, I understand will occur with the second blend immediately following the first blend. As you requested in our 12/17/96 telephone conversation, there is no need to separate those two test burns by a period of pure coal utilization.

Your November 4, 1996 letter to Mr. Charles Archer (Halifax, NC County Manager) states that the Weldon boiler unit # 2 is to be utilized in your initial trials. You further state that there are plans to expand the trials into boiler unit # 1. In your communications to Sherri Coghil and I, blend levels of 15% and 20% petroleum coke to coal have been indicated to be of primary interest. It may be worthwhile for me to restate that the DWM will require separate testing for each of the two boiler units. Likewise, different blend levels will have to be separately evaluated.

Maggie Estrada
December 19, 1996
Page 2

Sampling Protocol:

This section's discussion needs to be revised to accommodate the addition of test burning a fifteen percent blend to the twenty percent CPC fuel blends covered in the 12/11/96 letter. The proposed sequence of fuel changes is: begin with 100% coal, then changing to 85% coal/15% petroleum coke blend, next introducing the 80% coal/20% petroleum coke blend and finally changing back to 100% coal. Stable operating periods of twenty four hours each is necessary for each type fuel. Obtaining five representative, equally spaced samples is achieved by collecting those five samples at times of four, eight, twelve, sixteen and twenty hours into the twenty four hour periods. Since both bottom and fly ash by-products are proposed for beneficial use, samples of both of these types are required at each sampling event.

Analytical Protocol:

The two paragraphs appearing under this "Analytical Protocol" heading in the December 11, 1996 reference letter are still applicable. However, because the maximum storage time allowed by the US EPA prior to TCLP analysis for volatile and semi-volatile organics is only fourteen days, it will probably be necessary to concentrate initial analytical efforts on the organics. The maximum storage times for the inorganics are 28 days for mercury and 180 days for all others.

Please note that in the 12/11/96 letter, the table on page 3 indicated that only one sample (sample number 3 from each fuel type) needed to have a full TCLP analysis performed on it. This will be true only if no organics are detected in the 8240 and 8270 scans and also are not detected when running the sample #3 TCLP. **If organics are detected in any of the above instances, then it will be necessary to conduct full TCLP analyses on two additional samples from that fuel type and by-product type (bottom or fly ash).** It is recommended that the samples selected be samples 2 and 4.

On page 3, a revised testing level table is presented. This includes the two fuel blend levels proposed to be evaluated and a footnote on the full TCLP requirement to emphasize the organic TCLP expanded testing need as discussed above.

The following testing level is applicable to both the fly and the bottom ashes:

Analysis Required	Before Test Samples	During Fuel Blend #1 Test Burn Samples	During Fuel Blend #2 Test Burn Samples	After Test Samples
8240 Scan	1,3,5	1,3,5	1,3,5	1,3,5
8270 Scan	"	"	"	"
Totals,(metals only*)	1,3,5	1,3,5	1,3,5	1,3,5
TCLP,(metals only*)	1,5	1,5	1,5	1,5
Full TCLP (no herb. or pest. are required) **	3***	3***	3 ***	3 ***

Footnotes: * analyses for "totals" metals must be a search for and quantification for any detected. The TCLP (metals only) analysis must be for any metals detected in the "totals" search.

** The full TCLP must be for the above detected metals, the TCLP regulated organics (except for herbicides and pesticides) plus any additional organics which exhibit significant peaks in the 8240 and 8270 scans.

***If organics are detected either in running this TCLP or in conducting the 8240 or 8270 scans, then additional full TCLP analyses must be done on samples 2 and 4.

The detection levels utilized in the TCLP analyses must be the lowest practical reporting limits attainable by the analytical laboratory selected to characterize the by-products. It is very important that this capability be discussed with the laboratory(ies) and that emphasis be placed on this factor when selecting a laboratory. I am repeating this section from the 12/11/96 letter to make certain that the importance continues to be noted.

Maggie Estrada
December 19, 1996
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Please contact me at 919-733-0692, ext. 260 if you have any questions.

Sincerely,


William R. Hocutt
Waste Determination Coordinator
Solid Waste Section

cc: Dexter R. Matthews
James C. Coffey
Terry Dover
Sherri Coghill

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State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director



December 11, 1996

Ms. Maggie Estrada
LG&E POWER
3200 Park Center Drive, Suite 400
Costa Mesa, CA 92626

Dear Ms. Estrada:

The purpose of this letter is to provide you with the NC DEHNR, Division of Waste Management (DWM) Beneficial Use sampling and analysis protocols. This is for the upcoming test burn of coal:petroleum coke (CPC) fuel blends at your Weldon, NC facility. Since you have indicated that your company desires to evaluate the bottom ash as well as the fly ash, we will require that both types of ash by-products be evaluated at equivalent levels. This will be true even if your plans are to beneficially use a mixture of the two ash by products.

It will be necessary to conduct a test burn of CPC lasting a minimum of twenty four hours in order to obtain adequate samples for characterization of the combustion by-products. The Division of Air Quality should be contacted to allow their option of monitoring the burn. The reason for Air Quality's involvement is that emission test results **could** indicate stack modifications being necessary to accommodate this change in the boiler fuel feedstock. The ash chemistry would be expected to be altered once any required stack modifications are made. This, therefore, could impact the planning on when to collect the samples for chemical characterization. Also, any requirements to modify the boiler stack to accommodate the utilization of CPC could involve costs that could significantly alter anticipated economic benefits from the fuel change.

Your November 4, 1996 letter to Mr. Charles Archer (Halifax, NC County Manager) states that the Weldon boiler unit # 2 is to be utilized in your initial trials. You further state that there are plans to expand the trials into boiler unit # 1. In your communications to Sherri Coghill and I, blend levels of 15% and 20% petroleum coke to coal have been indicated to be of primary interest. It may be worthwhile for me to restate that the DWM will require separate testing for each of the two boiler units. Likewise, different blend levels will have to be separately evaluated on both boiler units.

P.O. Box 27687,
Raleigh, North Carolina 27611-7687
Voice 919-733-4996



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Sampling Protocol:

The DWM has adopted a sampling protocol to allow characterization of the CPC combustion by-products as compared to those from one hundred percent coal. Sampling involves first the collection of five samples each of fly ash and of bottom ash obtained at equally spaced time intervals during the twenty four hours (minimum) of normal operation just prior to the test burn. This same sampling level and procedure is then followed for the twenty four hour (minimum) test burn period and then for a twenty four (minimum) normal operation period immediately following the test burn. This scale of sampling will provide adequate analytical samples plus back-up samples for characterization of the combustion by-products.

Analytical Protocol:

It will be necessary to first determine what contaminants are present and obtain a measurement of the level of "totals" for those constituents. In the case of inorganics, a representative sample is digested in nitric acid using procedure 3050A or 3051 (microwave assisted) and then atomic adsorption and atomic emission techniques are utilized to identify and quantify all metals present. This yields a "totals" content measurement for any metals present. It will then be necessary to determine the leachability of those metals. This must be done using the TCLP protocol. We will allow use of either the appropriate US EPA leaching solution specified in SW846 or the use of artificial NC acid rain which has been demonstrated on one waste (only) as being less aggressive. To make this acid rain solution, a 70:30 (by volume) mixture of 0.1 N solutions of sulfuric:nitric acids is added to DI water until a 4.6 pH is obtained. A 0.1 N sodium hydroxide solution can be used for "back" titration to facilitate obtaining the required pH. Trace elements and compounds normally found in acid rain are not added in the artificial acid rain solution. The TCLP analysis must quantify the leachability of any metals detected in the "totals" measurement.

The organic constituents present are determined by running 8240 and 8270 scans. The scans must not only search for the listed compounds, but must also include up to 5-10 of any unidentified compounds exhibiting large peaks (known as TICs) in the chromatogram. Identification and quantification of the listed and additional large peak compounds can be accomplished with an NIST or an in-house library. This will provide a "totals" measurement for the organics. A TCLP analysis to determine the leachability of the listed and additional organic compounds must then be made using the standard appropriate US EPA solution or acid rain as described above for the metals. The leaching solution used must be consistent (must be the same) for both the organic and inorganic constituents.

The following testing level is applicable to both the fly and the bottom ashes:

Analysis Required	Before Test Samples	During Test Burn Samples	After Test Samples
8240 Scan	1,3,5	1,3,5	1,3,5
8270 Scan	"	"	"
Totals,(metals only*)	1,3,5	1,3,5	1,3,5
TCLP,(metals only*)	1,5	1,5	1,5
Full TCLP (no herb. or pest. are required) **	3	3	3

Footnotes: * analyses for "totals" metals must be a search for and quantification for any detected. The TCLP (metals only) analysis must be for any metals detected in the "totals" search.

** The full TCLP must be for the above detected metals, the TCLP regulated organics (except for herbicides and pesticides) plus any additional organics which exhibit significant peaks in the 8240 and 8270 scans.

The detection levels utilized in the TCLP analyses must be the lowest practical reporting limits attainable by the analytical laboratory selected to characterize the by-products. It is very important that this capability be discussed with the laboratory(ies) and that emphasis be placed on this factor when selecting a laboratory.

These data are to be submitted to the DWM for beneficial use suitability evaluation and for evaluation by state toxicologist(s) for risk assessment. Since there will be a rather large amount of data and since proper identification of the data is critical, I suggest that the raw data be tabulated. This will be especially useful when I submit it to the toxicologists. We will need a copy of the raw data even if you do choose to tabulate it.

Maggie Estrada
December 11, 1996
Page 4

One additional item which may become an important factor in the beneficial use of this CPC blended fuel is the possible need for monitoring wells at the project sites. A major concern which frequently develops in risk assessments is the potential for groundwater contamination. I wanted to mention this now to make you aware of that possibility.

Please contact me at (919) 733- 0692, extension 260 if you have questions.

Sincerely,



William R. Hocutt
Waste Determination Coordinator
Solid Waste Section

cc: Dexter R. Matthews
James C. Coffey
Sherri Coghill

c:wp6doc/letter/lgepwr01.96

LG&E Power Development Inc.
3200 Park Center Drive, Suite 400
Costa Mesa, California 92626
714-241-4700
714-241-4790 FAX

December 5, 1996

Mr. Bill Hocutt
State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Waste Management
Solid Waste Department
512 N. Salisbury Street
P.O. Box 29535
Raleigh, NC 27604

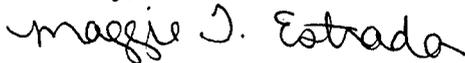
Subject: Information for Beneficial Reuse Test Procedure
Petroleum Coke Test Burn
Roanoke Valley Energy Facility

Dear Mr. Hocutt:

To confirm our discussions today regarding the scheduled petroleum coke test burn at the Roanoke Valley Energy plant, we would like you to consider for beneficial reuse both fly ash and bottom ash, each generated from a 15% and a 20% petroleum coke/coal fuel blend. Please incorporate the necessary testing for the desired ash types and blend percentages into the test procedure you will be preparing. As agreed, we will submit the initial mixed ash test results (to be performed for ash disposal purposes) as soon as they are available. This data will be helpful to you in minimizing the required testing outlined in the test procedure. The initial data, in conjunction with the data obtained from the beneficial reuse testing, will assist you in your review and determination of the mixed ash for beneficial reuse and the preparation of the guidance policy.

Should you have any questions or require additional information, do not hesitate to call me at (714) 241-4773. Your efforts to complete the test procedure by mid December are greatly appreciated.

Sincerely,



Maggie T. Estrada
Senior Environmental Engineer

cc: ~~██████████~~, Solid Waste Section

B. Hamilton
Q. Morrison
D. Ray
C. Archer, Halifax County
esd file/rvp.3.6

State of North Carolina
 Department of Environment,
 Health and Natural Resources
 Division of Waste Management

James B. Hunt, Jr., Governor
 Jonathan B. Howes, Secretary
 William L. Meyer, Director



November 22, 1996

Ms. Maggie Estrada
 LG&E POWER
 3200 Park Center Drive, Suite 400
 Costa Mesa, CA 92626

Post-it® Fax Note	7671	Date	11/22/96	# of pages	4
To	MAGGIE ESTRADA	From	BILL HOCUTT		
Co./Dept.	LG&E POWER	Co.	NC DEHNR		
Phone #		Phone #	919-733-0172	EXT 200	
Fax #	714-241-4794	Fax #			

Dear Ms. Estrada:

Please find attached a draft copy of a status report of Beneficial Use Policy development will perhaps prove useful to you. Please note that the NC Beneficial Use Policy Program has only recently evolved to a sufficient level of development that requirements can be specified.

One factor not mentioned in our discussions this afternoon is what portion(s) of the coal:coke combustion by-products are being considered for use in structural fills. Will it be fly ash only, fly and bottom ash (separate or combined), fly and bottom and slag (separate or combined), etc. ?

Sincerely,

William R. Hocutt
 William R. Hocutt
 Waste Determination Coordinator
 Solid Waste Section

cc: Sherri L. Coghill

c;wp6doc/letter/coalcoke.01

November 21-22; 1996 Solid Waste Retreat; In Raleigh, After Hurricane Fran Evacuation from Atlantic Beach on September 5.

DRAFT

BENEFICIAL USE POLICY----- STATUS REPORT

A plan has been developed on how the Solid Waste Section is going to evaluate requests to beneficially use industrial wastes. The first step was to define beneficial use. Generators will obviously suggest very varied uses of their wastes, **many of which do not NORMALLY fall under our jurisdiction.**

Basically, the major condition is that the waste must be used in a function or application as an effective substitute for a commercial product or natural resource. This means that it must be used in its "as produced" form, not reacted with or mixed with other constituents to produce what we then define as a **NEW PRODUCT**. New products only fall under the Division of Waste Management's jurisdiction in special circumstances which I will cover shortly. But first to complete the definition, Beneficial Use further means projects promoting public health and environmental protection, offering equivalent success relative to other alternatives, and preserving natural resources.

If the waste **IS** converted to a **NEW PRODUCT**, the SWS will generally not be involved past the point of transport and storage requirements prior to the conversion. An example of this is when a scrap tire is converted to crumb for use in asphalt. The Section has requirements for transport and storage of scrap tires but the process of conversion to crumb does not require a permit. However, General Statute 130A-309.05, part (C) on page 171 of the 15A NCAC 13B Solid Waste Management Rules specifies three conditions which Recovered Materials must meet in order to **NOT** be subject to regulation by the SWS. These conditions are:

DRAFT

- (1) A majority of the recovered materials at a facility are sold, used, or reused within one year;
- (2) The recovered materials or the products or by-products of operations that process recovered materials are not discharged, deposited, injected, dumped, spilled, leaked, or placed into or upon any land or water so that the products or by-products or any constituent thereof may enter other lands or be emitted into the air or discharged into any waters including groundwater, or otherwise enter the environment or pose a threat to public health and safety; and
- (3) The recovered materials are not hazardous waste and have not been recovered from solid waste which is defined as hazardous waste under G.S. 130A-290.

Any proposed uses of recovered materials must satisfy all three conditions to be exempt from solid waste regulations. The SWS will use these conditions to evaluate proposed uses and may require additional information before a decision can be made.

The foregoing discussion defines to a degree what Beneficial Use **IS** and to a degree what **IT IS NOT**. We are certain that much additional fine tuning of the definition will be forthcoming as a result of our experience in processing future requests.

DRAFT

Initially, the plan was to develop RULES for Beneficial Use of waste materials. I began by canvassing some seven selected states to learn how they were handling these type requests. The state of New York's approach was stated by several states as being well advanced over their own programs. Subsequent contact with NY has resulted in our receiving considerable information about their B.U.D. (Beneficial Use Determination) program. Unfortunately, our own work load of Beneficial Use requests has prevented thorough review of all of the information that they have supplied. We do know that they use a case-by-case approach.

It soon became apparent that writing a set of single rules to cover all contingencies as to the chemistry of any waste which might be encountered was not the best approach. Such rules would be very lengthy and cumbersome. This led to our adopting a plan to issue POLICIES for guidance in Beneficial Use applications on a case-by-case basis. The major objective is to gain adequate knowledge of a waste's chemistry for the Division to determine how suitable the material is for a proposed use. Also, the procedure is to include submitting the data to a state toxicologist for an opinion on how protective of human health and of the environment is the proposed use.

DRAFT

The Solid Waste Section has adopted a procedure which expands the scope of leachable chemical constituents measured in a waste vs. those specified in the USEPA TCLP test. The objective is to make possible a case by case characterization for potential harm to the environment in utilization of industrial waste by-products in any particular end use. Risk assessments are being attempted through comparison of leaching results for the chemicals detected in a waste to the ground and drinking water established limits when such limits exist for those chemicals. Also, opinions are being sought from the state toxicologists on the advisability of the proposed uses.

In the case of the organic analyses, the 8240 and 8270 scans must not only include searches for the listed compounds but also include up to 5-10 of any additional compounds exhibiting large peaks (TICs) in the chromatogram. Identification and quantification of the listed and additional TICs can be accomplished with a NIST or an in-house library. This will provide a "totals" measurement for the organics. The TCLP test for organic constituents can then be expanded to include the TICs detected (as described above) to quantify their leachability as well.

Likewise, detection for what metals are present is being expanded beyond the eight RCRA metals specified in the USEPA TCLP test. "Total" metals analyses are made, the scan broadened to search for additional metals. Any metals detected at significant "total" levels are also then analyzed for leachability in addition to the eight RCRA metals.

The TCLP protocol can be followed exactly as specified in SW846, using the appropriate

DRAFT

leaching solution described therein or, as an alternative, the Solid Waste Section will accept results obtained using unbuffered artificial NC acid rain as the leaching solution. Artificial NC acid rain has been demonstrated on one waste (only) as being less aggressive than the specified SW846 leaching solutions which are designed to simulate municipal solid waste landfill conditions that are normally not appropriate for the targeted waste usage. To make this acid rain solution, a 70:30 (by volume) mixture of 0.1 N solutions of sulfuric:nitric acids is added to DI water until a 4.6 ph is obtained. A 0.1 N sodium hydroxide solution can be used for "back" titration to facilitate obtaining the required ph. Trace elements and compounds normally found in acid rain are not added in the artificial acid rain solution.

Two INTERIM Policies have been issued to date and for expediency, both were formatted by citing exceptions to the Section .1700 Coal Combustion By-Products Rules. One of these has now been written in complete draft form and is being reviewed. It is a policy for structural fills constructed with the fly ash from combustion of an 80:20 blend of coal:used tires at the Cogentrix Kenansville site. Elevated levels of arsenic and zinc are causing Cogentrix to consider retrying the test burn at their Southport site. The second interim Policy covers the use of waste ceramic tile in structural fills and also as aggregate in highway construction. Additional data is required before this policy can become operational.

DRAFT



County of Halifax

P. O. BOX 38
HALIFAX, N.C. 27839
919-583-1131

November 20, 1996

Maggie T. Estrada
Senior Environmental Engineer
LG&E Power Development, Inc.
3200 Park Center Drive, Suite 400
Costa Mesa, California 92626

Dear Ms. Estrada:

Halifax County has received the request from Westmoreland-LG&E Partners asking the County to accept the coal/coke ash from Roanoke Valley Energy Facility- Unit 2. We have also received a copy of the letter sent to you from Sherri Coghill, Environmental Engineer, with the North Carolina Division of Waste Management.

Halifax County is prepared to accept the coal/coke ash in our coal ash monofill provided the coal/coke ash is determined to be non-hazardous according to results of a TCLP analysis.

Regarding the request to have Halifax County store the coal/coke ash in the monofill, Halifax County concurs with the Division of Waste Management in that Westmoreland-LG&E must provide test results prior to disposal in the coal ash monofill. While the County does not have an indoor facility to temporarily store the coal/coke ash, any suitable arrangement made between Westmoreland-LG&E and the Division of Waste Management for temporary storage on County property will very likely be acceptable to the County.

The other issue of concern for the County relates to the possibility the Division of Waste Management may not allow coal/coke ash to be used for beneficial reuse. Currently, the County uses approximately 15,000 tons of coal ash per year as temporary daily cover at the landfill. This use of coal ash has greatly decreased our dependence on dirt for daily cover. If the Division determines coal/coke ash can not be used for beneficial reuse, the Halifax County landfill would be adversely affected, and we would like the opportunity to discuss this further at that time.

Sincerely,

Hazen Blodgett
Asst. County Manager

cc: Don Ray
Charles Archer
✓ Sherri Coghill
Richard Garner

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director



November 19, 1996

Maggie T. Estrada
Senior Environmental Engineer
LG&E Power Development, Inc.
3200 Park Center Drive, Suite 400
Costa Mesa, California 92626

Re: Ash Disposal/Reuse
Roanoke Valley Energy Facility
Halifax County, North Carolina

Dear Ms. Estrada:

The Solid Waste Section received your request for information regarding the effects of combustion of a mixture of petroleum coke and coal on current disposal methods and beneficial reuses for the ash generated at Roanoke Valley Energy Facility. The combustion by-products produced by firing both petroleum coke and coal will have different properties than the by-products of the combustion of 100% coal and will be considered different waste streams from those currently generated.

The permit for the Halifax County Ash Monofill allows for disposal of additional waste streams such as the coal/coke ash. If representative samples of the coal/coke ash at each of the varying coke percentages prove non-hazardous as determined by TCLP analysis (RCRA metals and at least one set of organics), contain no free liquids and pH levels are satisfactory, then the Solid Waste Section will allow disposal of the material in the ash monofill. Roanoke Valley Energy Facility must provide test results to the Section prior to disposal. Therefore, arrangements for storage of ash, within closed containers or indoors, prior to disposal should be made. Please provide the Section with proposed methods for obtaining a representative sample and for storage of ash prior to disposal.

The Solid Waste Management Rules regarding beneficial reuse of coal combustion by-products apply only to wastes generated from combustion of one hundred percent coal. The Solid Waste Section does not plan to adopt additional rules regarding beneficial reuse, but will review requests on a case-by-case basis and issue a specific guidance policy if approved. Your request to beneficially reuse the coke/coal combustion by-products will be considered by the Section. I have forwarded a copy of your request to Bill Hocutt, section contact regarding beneficial reuse, for review. Mr. Hocutt is currently drafting a guidance policy on beneficial reuse of by-products produced from the combustion of a blend of coal and tire-derived fuel. A copy of that document

P.O. Box 27687,
Raleigh, North Carolina 27611-7687
Voice 919-733-4996



FAX 919-715-3605
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Ms. Estrada
November 19, 1996
Page 2

will be forwarded to you when available.

Also , for your information, Halifax County has inquired about omitting the geosynthetic liner in the design of the next monofill cell. A change in waste stream may impact this potential design change.

If you have questions or need additional information, please contact me at (919) 733-0692, extension 259.

Sincerely,



Sherri L. Coghill
Environmental Engineer
Solid Waste Section

cc: Hazen Blodgett, Halifax County
William R. Hocutt
Ben Barnes
Terry Dover

Ms. Estrada
November 19, 1996
Page 2

will be forwarded to you when available.

Also , for your information, Halifax County has inquired about omitting the geosynthetic liner in the design of the next monofill cell. A change in waste stream may impact this potential design change.

If you have questions or need additional information, please contact me at (919) 733-0692, extension 259.

Sincerely,



Sherri L. Coghill
Environmental Engineer
Solid Waste Section

cc: Hazen Blodgett, Halifax County
William R. Hocutt
Ben Barnes
Terry Dover

November 18, 1996

Sherri Coghill
Solid Waste Section
State of North Carolina Department of Environment,
Health and Natural Resources
P.O. Box 27687
Raleigh, NC 27611-7687

Re: Halifax County Coal Ash Monofill
Cell 2 Expansion
H&S No. 3786

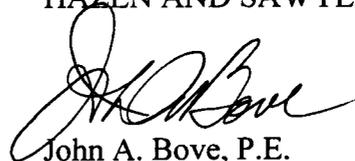
Dear Ms. Coghill,

The purpose of this letter is to inform you that the construction of Cell 2 of the Halifax County Coal Ash Monofill has been postponed. Due to the success of the beneficial ash reuse program, the owner has decided to delay construction for approximately twelve months. The project will be reviewed in six months to evaluate need for the expansion. There is no plan to revise the approved Cell 2 design. We will notify you in advance of construction so you will be able to attend the preconstruction meeting and monitor construction.

If you have any questions or require additional information, please feel free to contact us.

Very truly yours,

HAZEN AND SAWYER, P.C.



John A. Bove, P.E.
Senior Principal Engineer

cc: Don Ray Westmoreland - LG&E
Hazen Blodgett, Halifax County

November 4, 1996

*LG&E Power Development Inc.
3200 Park Center Drive, Suite 400
Costa Mesa, California 92626
714-241-4700
714-241-4791 FAX*

Mr. Charles Archer
County Manager
County of Halifax
P.O. Box 38
Halifax, North Carolina 27839

Re: Roanoke Valley Energy Facility
 Weldon, NC

Subject: Proposed Petroleum Coke Test Burn

Dear Mr. Archer:

Westmoreland-LG&E Partners is investigating the feasibility of co-firing an alternative fuel in the existing pulverized coal boilers at the Roanoke Valley Energy Facility. The fuel under consideration, petroleum coke, has similar properties to the bituminous coal that is currently permitted for use. Petroleum coke is a solid material byproduct of the petroleum refining process and is commonly used in power and industrial boilers. Co-firing the existing pulverized coal boilers with up to 20% petroleum coke will allow increased flexibility in fuel suppliers and can decrease fuel costs substantially. Since using this coal and petroleum coke mixture varies from the fuel that is currently used on-site, and therefore the generated ash, we are requesting that the County of Halifax review the information provided and give us an approval to accept the test ash mixture. We are also informing the NCDEHNR, Solid Waste Department of the petroleum coke test burn. A copy of the Proposed Test Plan is attached for your review. We are also requesting that the NCDEHNR, Solid Waste Department confirm of our interpretation of the definitions as noted in the state and federal regulations for solid waste and beneficial use.

In order to determine the feasibility of using petroleum coke in the existing boilers, a test burn in Unit 2 (RVP II) is proposed beginning on December 2, 1996. The objective of the test burn is to demonstrate that:

- the existing equipment, including pulverizers, emission and effluent control equipment, material handling and conveying, etc., is compatible with the coke/coal mixture
- the boiler efficiency, air control systems, wastewater control system, and ash disposal practices are not adversely affected
- all environmental permit conditions can be met while using the coal/coke fuel mixture.

As shown in the Test Plan, the Unit 2 test burn will take approximately 20 days to complete. However, the test schedule may be extended until all the purchased petroleum coke is consumed. During the test burn, petroleum coke will be gradually introduced to one pulverizer at a time, in increments of 5%, 10%, 15% and 20%, and the combustion process will be stabilized for each

To verify actual constituents and properties differences that may occur in the ash mixture during the test burn, Toxicity Characteristic Leaching Procedure (TCLP) tests for RCRA metals will be performed on the petroleum coke/coal ash mixture to determine the toxicity characteristics. The ash mixture will be tested at the varying percentage values (5%, 10%, 15%, and 20%). This will give a true indication of the constituents and concentration levels of the ash mixture generated. The results of the tests will be reviewed and evaluated to ensure compliance with the regulatory levels. As the test results are received from the laboratory, they will be forwarded to the Solid Waste Department and Halifax County. In addition to the TCLP tests, lime, carbon, and density/compact type tests will be performed to determine the structural properties and pollutant levels of the ash mixture. These tests will be performed at the varying percentage values. This information will also be forwarded with the TCLP test results to assist in the determination of the ash mixture being used as a beneficial use product. If the results of the TCLP tests performed on the test burn generated ash mixture indicate toxicity characteristics, the NCDEHNR, Solid Waste Department and Halifax County will be notified as soon as possible for determination of an alternative ash mixture disposal method.

In support of the test burn, a literature review and telephone survey have been conducted to collect data from other coal burning facilities that have experience in co-firing petroleum coke. As part of this survey, we have requested mixed ash TCLP test results from several of these facilities for comparison purposes. If the data is received in a timely period, we will forward it to you to assist in your review.

Currently, Halifax County accepts the coal ash from the plant and either disposes it in the landfill in the plant specific monocell or uses it as a beneficial use product. The option to use the mixed ash as a beneficial use product is extremely cost effective for the plant, and even with the fuel mixture modification, it is desirable to continue exercising that disposal method. In light of this, the final definition of a beneficial use is very important when considering the viability of using petroleum coke as an additive fuel.

The proposed test burn will provide the Roanoke Valley Energy Facility with the flexibility to properly evaluate the advantages of co-firing petroleum coke. Assuming that the test burn results demonstrate that a petroleum coke mixture is a viable alternative fuel, the facility will conduct a test burn on Unit 1 in February, 1997. The data collected from the test burns will allow the facility to evaluate if permanent use of this fuel mixture is beneficial to the plant. This data will then be submitted to the NCDEHNR, Solid Waste Department and to Halifax County for review and record. NCDEHNR, Solid Waste Department will be notified in writing if it is determined to permanently use the petroleum coke mixture as an on-site fuel. Prior approval by Halifax County to accept the mixed ash on a permanent basis will be received before this decision is made by the plant.

During the test burn, petroleum coke will be gradually introduced to one pulverizer at a time, in increments of 5%, 10%, 15% and 20%, and the combustion process will be stabilized for each mixture. This also allows for the capability of a coal-only option in the boiler in case problems are encountered. Once it is demonstrated that the boiler and associated equipment can be stabilized using the coal/coke mixture, each system will be optimized and extensive testing will commence. It is expected that approximately 2000 tons of the coal/petroleum coke ash will be generated during the test burn.

Using a mixture of petroleum coke in the boilers may effect the ash generated at the plant. It will no longer be considered ash generated by only coal. However, as defined in the federal regulation 40 CFR 261.4 and as incorporated by reference in the state Solid Waste Management regulations, the ash mixture generated would still be considered a solid waste and not a hazardous waste. The definition states "fly ash waste, bottom ash waste, slag waste, and flue gas emission control waste, generated primarily from the combustion of coal or other fossil fuels" are specifically stated as not a hazardous waste. Since the petroleum coke is considered an "other fossil fuel" and the ash is "primarily" generated from the combustion of coal (80%), we understand that the ash mixture is covered under this definition as a solid waste. We request that the Solid Waste Department confirm this conclusion.

The other important issue related to the petroleum coke test burn and the ash mixture generated is the ability to use this ash mixture as a beneficial use product. The state Solid Waste Management regulations, Section .1700, allow coal combustion by-products to be used as structural fill with a projected beneficial end use, if properly placed and compacted. As defined, "coal combustion by-products are residuals, including fly ash, bottom ash, boiler slag and flue gas desulfurization residue produced by coal fired electrical or steam generation units". Because the definition does not specify "and other fossil fuels" or "primarily coal", we are requesting confirmation by the NCDEHNR, Solid Waste Department that the ash mixture could still be utilized as a beneficial use product. A more specifically written definition would be appropriate to address this uncertain area of the regulations.

The incorporation of this different fuel type may possibly change the constituents and/or their concentration levels in the resulting ash. Although any difference in ash quality is believed to be negligible due to the small quantities of petroleum coke used in the boiler (maximum of 20%), and of that quantity, the insignificant quantities of petroleum coke ash generated (0.5%). In addition, less mixed ash will be required to control SO₂ emissions in the Flue Gas Desulfurization (FGD) system. It should be noted however, that more lime will be used in the FGD system with the use of the mixed ash to allow for the additional sulfur removal. This will cause an increase of waste produced in the FGD system, therefore in the total ash production. Also, the carbon content of the mixed ash may also be higher than the coal ash as a result of incomplete combustion of petroleum coke. Although the effects are probably negligible, the effects to the properties of the ash mixture due to this additional lime and carbon should be addressed.

It may assist you in your review process to know that we are also informing or seeking approvals for the proposed test burn from the Air Quality Division and the Storm Water Group of the NCDEHNR, Halifax County, as well as the Town of Weldon Waste Water Treatment Facility. Your review and determination that the ash mixture is considered a solid waste and that it can be used as a beneficial use product will allow economic advantages to the project. We look forward to working with you regarding our request and appreciate your timely assistance in this matter. Our goal is to obtain all approvals by November 18, 1996 in order to proceed with fuel procurement and other arrangements in time for the December 2, 1996 test burn. Should you have any questions, do not hesitate to call me at (714) 241-4773.

Sincerely,

Maggie T. Estrada

Maggie T. Estrada
Senior Environmental Engineer
Environmental Services

Enclosures

pcash

cc: B. Hamilton
D. Ray
Q. Morrison
C. Archer, Halifax County
esd file/rvp.3.6

Attachment 1
Proposed Test Plan

**ROANOKE VALLEY ENERGY FACILITY
UNIT II
PROPOSED PETROLEUM COKE TEST PLAN**

Day	Coal / Coke Mixture		Test Parameters	Notes
	Mill A	Mill B		
Phase I				
1	95% Coal 5% Coke	100% Coal	Flame stability, scrubber stability, urea consumption	Days 1 -3: Begin 15% test burn. Gradually increase coke mixture to one mill.
2	90% Coal 10% Coke	100% Coal	Flame stability, scrubber stability, urea consumption	
3	85% Coal 15 % Coke	100% Coal	Flame stability, scrubber stability, urea consumption	
4	85% Coal 15 % Coke	95% Coal 5% Coke	Flame stability, scrubber stability, urea consumption	Days 4 - 6: Introduce coke mixture to second mill.
5	85% Coal 15 % Coke	90% Coal 10% Coke	Flame stability, scrubber stability, urea consumption	
6	85% Coal 15 % Coke	85% Coal 15 % Coke	Flame stability, scrubber stability, urea consumption, collect ash sample	
7	85% Coal 15 % Coke	85% Coal 15 % Coke	Optimize Boiler: boiler efficiency test, scrubber performance test	Days 7 - 10: Steady state optimization run at 15% mixture.
8	85% Coal 15 % Coke	85% Coal 15 % Coke	Continue	
9	85% Coal 15 % Coke	85% Coal 15 % Coke	Continue	
10	85% Coal 15 % Coke	85% Coal 15 % Coke	Continue	
Phase II				
11	80% Coal 20% Coke	85% Coal 15% Coke	Flame stability, scrubber stability, urea consumption	Days 11-12: Increase coke mixture to 20%.
12	80% Coal 20% Coke	80% Coal 20% Coke	Flame stability, scrubber stability, urea consumption, collect ash sample	
13	80% Coal 20% Coke	80% Coal 20% Coke	Pulverizer fineness, flame stability/optimization (PA/SA split, flame shape), NOxOUT system (consumption changes, injection locations, NH3 slip), scrubber	Days 13 - 15: Detailed system checkout under steady state operation. Optimize all systems.

**ROANOKE VALLEY ENERGY FACILITY
UNIT II
PROPOSED PETROLEUM COKE TEST PLAN**

Day	Coal / Coke Mixture		Test Parameters	Notes
	Mill A	Mill B		
			operation/removal efficiency, lime consumption, fuel handling system.	
14	80% Coal 20% Coke	80% Coal 20% Coke	continue	
15	80% Coal 20% Coke	80% Coal 20% Coke	continue	
16	80% Coal 20% Coke	80% Coal 20% Coke	Boiler efficiency test Scrubber performance test Stack emissions Test	Days 16 - 20: Full load operation with optimized combustion and NOxOUT system.
17	80% Coal 20% Coke	80% Coal 20% Coke	continue	
18	80% Coal 20% Coke	80% Coal 20% Coke	continue	
19	80% Coal 20% Coke	80% Coal 20% Coke	continue	
20	80% Coal 20% Coke	80% Coal 20% Coke	continue	

Comments:

1. Rational for starting with one mill (A):
 - Small step changes within one firing system
 - Lowest mill in boiler (best burn-out opportunity)
 - Maintains coal-only capability in boiler (2 silos available in case of problems)

2. CEM system will be operational at all times during test burn to monitor SO₂, SO₂ removal, NO_x, flue gas flow rate, flue gas temperature.

3. DCS will log and print pulverizer fuel flow, urea consumption, lime consumption, gas temperature at scrubber inlet, etc.

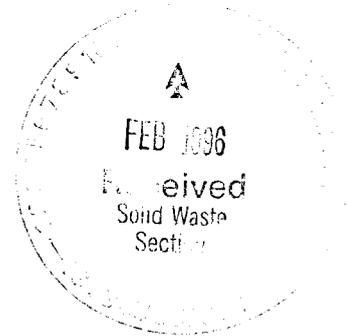
- Booklet -

42-04

Construction Quality Assurance
(COA) Program for Construction
of Halifax County Ash Monofill-
Cell 2

1996

**CONSTRUCTION QUALITY ASSURANCE (CQA)
PROGRAM FOR CONSTRUCTION OF
HALIFAX COUNTY ASH MONOFILL-CELL 2**



Construction Quality Assurance (CQA) for the construction of Halifax County Ash Monofill Cell 2 (the Cell) will be provided by a consulting engineering firm specializing in the inspection and testing of soils and geosynthetics, (the Engineer). Resumes and qualifications of the project team members will be provided to the County for their review.

The project team providing the CQA services shall consist of the following:

- A. Project Engineer - Responsible for defining quality assurance requirements compatible with the project objectives, verifying basic data as reasonable and complete, outlining procedures to process data, developing statistical procedures for the analysis of test data and preparing quality assurance memorandums and quality control assessment reports. Construction certification documents will be prepared, signed and sealed by the Project Engineer. The Project Engineer will be a registered Professional Engineer in the state of North Carolina and will report to the County.

- B. Construction Quality Assurance Officer - Responsible for the field implementation of the approved quality assurance plan as follows:
 - Monitor the quality assurance activities of the field laboratory, assuring conformance with authorized policies, procedures, and sound practices, and recommended improvements as necessary.
 - Inform the Project Engineer of non-conformance to the approved CQA program plan.
 - Assure that sampling is conducted in a manner consistent with approved guidelines.
 - Approve field laboratory data before the data are reported or entered into the data base for analysis.

APPROVED
DIVISION OF SOLID WASTE MANAGEMENT
DATE 5/17/96 BY SJC

- Maintain an awareness of the entire field laboratory operation to detect conditions which might directly or indirectly jeopardize the quality of laboratory testing.
- Assure that sample handling procedures are in accordance with the appropriate guidelines for the testing to be conducted.
- Oversee the quality of purchased laboratory materials to insure that purchases do not jeopardize the quality of the testing results.

The Construction Quality Assurance Officer will be experienced in quality assurance testing and inspection. The Construction Quality Assurance Officer will report to the Project Engineer.

- C. Engineering Technicians - Responsible for field observations, testing and inspection. Technicians will be assigned to the project as deemed necessary by the Construction Quality Assurance Officer and will be responsible to the Construction Quality Assurance Officer.

REFERENCE LIST OF STANDARDS

(See Individual CQA Program Sections for Referenced Test Methods)

- ASTM C136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D413 - Test Method for Rubber Property - Adhesion to Flexible Substrate
- ASTM D422 - Standard Method for Particle-Size Analysis of Soils
- ASTM D638 - Standard Test Method for Tensile Properties of Plastics
- ASTM D698 - Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 4.4 lb. (2.49 kg) Rammer and 12-inch (305 mm) Drop
- ASTM D751 - Standard Methods of Testing Coated Fabrics
- ASTM D792 - Standard Test Methods for Specific Gravity and Density of Plastics by Displacement
- ASTM D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting
- ASTM D1238 - Test Method for Flow Rates of Thermoplastic by Extrusion Plastometer
- ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method
- ASTM D1557 - Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18-in. (457 mm) Drop
- ASTM D1593 - Specification for Nonrigid Vinyl Chloride Plastic Sheetings
- ASTM D1603 - Test Method for Carbon Black in Olefin Plastics
- ASTM D2172 - Standard Test Methods for Extraction of Bitumen from Bituminous Paving Materials
- ASTM D2216 - Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
- ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- ASTM D2937 - Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
- ASTM D3015 - Recommended Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds

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- ASTM D3083 - Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining
- ASTM D3776 - Test Method for Weight (mass) per Unit Area of Woven Fabric
- ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method
- ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
- ASTM D4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
- ASTM D4716 - Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products
- ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile
- ASTM D4833 - Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
- ASTM D5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

National Sanitation Foundation (NSF) Standard Number 54-Flexible Membrane Liners

I. LINES AND GRADES

1. The lines and grades shall be established by the General Contractor using control points established in the Contract Drawings as well as other required control points established using survey techniques and approved by the Engineer.
2. Before staking the various construction points, the Contractor shall furnish calculations to the Engineer or his representative for review. The General Contractor shall give the Engineer sufficient notice to observe the location activities.
3. The Engineer or his representative will perform spot checks using appropriate surveying methods to check for significant errors in the staking of control points.

II. Excavation

A. Soils

1. During site preparation, the exposed subgrade will be visually inspected to assure that all topsoil, vegetation, organic materials and other unsuitable materials are identified, removed and stockpiled in the appropriate location.
2. No stumps, logs or debris should be placed in the topsoil stockpile.
3. No topsoil or other organic natural should be placed in stockpiles to be used in compacted fill for Compacted Soil Liner or Compacted Embankment.

4. If large areas of unsuitable materials not previously identified in the Contract Drawings are encountered, the Engineer and the County are to be notified prior to removal of such areas.

B. Rock

1. The definition of rock shall be as stated in the Contract Specifications.
2. If rock is encountered, the Engineer and the County are to be notified immediately. The methods and equipment used by the General Contractor will be recorded.
3. The General Contractor will be requested to demonstrate that the rock cannot be removed using the excavation equipment specified in the Contract Specifications. Removal is to be attempted at least in the directions parallel and perpendicular to the strike of the rock formation.
4. Once the presence of rock has been verified by the Engineer, the excavation will be monitored to measure the quantity of rock removal. Such measurements will include surveying, direct measurement using a tape, or counting the number of full loads of material removed.
 - 4.1 The method of determining rock quantity is to be agreed to between the General Contractor, Engineer and the County before excavation begins.

C. As-Built Conditions

1. The As-Built drawings will record the preconstruction existing conditions, the elevations representing the base of the excavated areas, and the limits of rock excavation, where applicable. The General Contractor is responsible for recording As Built lines and grades. The Engineer will monitor and check lines and grades as required to assure reasonable accuracy.

III. COMPACTED EMBANKMENT

A. Placement of Compacted Embankment Fill

1. All required field density and moisture content tests will be completed before the overlying lift of soil is placed. The surface preparation (e.g. wetting, drying, scarification, etc.) will be completed before the Engineer will allow placement of subsequent lifts.
2. Each load of soil will be visually examined either at the borrow source or at the Cell itself. Any material that does not conform to the Contract Specifications will be removed.
3. Moisture content will be monitored by the Engineer or his representative prior to compaction. If the soil is dry of optimum moisture content, the General Contractor may be required to wet the lift and disc or otherwise evenly distribute the moisture over the lift.

4. The thickness of the loose lift will be measured several times daily at random locations after spreading and leveling is completed by the General Contractor. Loose lift thickness should not exceed 10 inches for a final 6-inch compacted lift thickness. For a bridging layer, the loose lift thickness may exceed 10 inches and may be adjusted in the field by the Engineer. Lift thickness may be measured using surveying, excavation or by driving a steel pin.

B. Compacted Coal Ash

1. When specified in the Contract Documents, coal ash may be included in Compacted Embankment as part of an approved beneficial reuse program. Placement and compaction are generally completed using methods outlined for Compacted Embankment.
2. Dust control may be required for coal ash used as Compacted Embankment. Wetting or prompt covering with additional coal ash or soil are usual dust control methods.
3. Coal ash that has "set" such that it cannot be broken down into agglomerate 4 inches or less in size will be returned to the monofill for disposal.
4. The General Contractor will use survey control methods to record coal ash locations and to control final thickness where appropriate.

C. Field Density Testing Equipment

1. All testing equipment shipped to the job site will be inspected to insure that it is in proper working order and meets the appropriate ASTM specifications or the manufacturer's specifications. All testing equipment will be assigned an inventory control number and these numbers will be recorded in the field job book. The inventory control numbers will be used in the documentation of the calibration of the equipment.
2. Field density tests will be conducted using a nuclear density gauge as outlined in ASTM D2922. At selected locations, field density tests will be conducted using the sand cone method (ASTM D1556) for comparison with the results of the nuclear density gauge.
3. At the beginning of each day, the manufacturer's recommendations for calibration of the nuclear density gauges will be followed.
4. Whenever a nuclear density gauge is "powered-up", moisture and density standard counts will be taken and entered into each gauge's log. This log will be reviewed weekly to detect sudden changes that would indicate a gauge defect.
5. Once a week, each gauge will be checked for stability and drift. A statistical data analysis will be used to detect a gauge's instability. If an unstable gauge is detected, it will be tagged as out-of-service and will not be used until repaired by the manufacturer's representative.

6. Nuclear density gauges marked out-of-service will be removed from the job site at the end of that shift.

C. Frequency of Field Density Testing

1. The area of the Compacted Embankment will be divided into equal segments and shown on the Engineer's grid layout drawing prepared prior to construction. Each segment will be assigned a number. No less than five field density tests will be performed for each full compacted lift at grid locations selected at random by the Engineer or his representatives.
2. Two bulk samples of the Compacted Embankment for each full lift will be collected at random locations by the CQA officer during placement or compaction. The following tests will be performed:
 - 2.1 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures, ASTM D2216.
 - 2.2 Method for Particle-Size Analysis of Soils, ASTM D422.
 - 2.3 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils, ASTM D4318.
3. The testing described above may be waived if appropriate prequalification testing has been completed at the borrow or stockpile location.

IV. COMPACTED SOIL LINER — NOT APPLICABLE

V. GEOMEMBRANE (POLYPROPYLENE, PPE)

A. Geomembrane Manufacturer

1. The General Contractor will submit the following, as obtained from the Geomembrane Manufacturer, to the Engineer:

- Production Certification including project references
- Testing Program for Compound Ingredients
- Material Certification
- Test Data for Material and Resin
- Other information required by the Contract Specifications

1.1 All of the above submittals will be reviewed and retained by the Engineer.

1.2 If any of the above submittals do not conform to the Contract Specifications, the Engineer will notify the General Contractor and the County.

B. Geomembrane Installation

1. The General Contractor will submit the following to the Engineer prior to installation:

1.1 Qualifications of Geomembrane Contractor Superintendent and Foreman

- 1.2 Resumes of Geomembrane Contractor field crew
 - 1.3 Six sets of field geomembrane erection drawings
 - 1.4 Quality Control Certificates
2. The above submittals will be reviewed and retained by the Engineer to verify conformance with the Contract Specifications. Materials not conforming will be rejected.
 3. An initial CQA meeting will be held prior to installation. The General Contractor, Geomembrane Contractor, Engineer or his representative, and a representative of the County will be in attendance. The following issues will be discussed and agreed upon by all parties.
 - 3.1 Testing of seams,
 - 3.2 Characteristics of "good" seam,
 - 3.3 Repair procedures, and
 - 3.4 Destructive and nondestructive testing procedures.
 4. The CQA Officer or his representative will sample rolls from each shipment of geomembrane delivered to the site. The minimum number of rolls to be sampled for each shipment will be determined by the Contract Specifications.
 - 4.1 The minimum conformance sampling criteria shall be as outlined in the Contract Specifications.
 - 4.2 The random samples must be representative of the material supplied and exclude the outer wrap of geomembrane if signs

of scuffing or other damage is observed. Samples should be full roll width and at least 3 ft. long.

4.3 The CQA Officer or his representative will measure the thickness of each of the random geomembrane samples at the project site prior to geomembrane installation. Material that does not fall within acceptable thickness criteria outlined in the Contract Specifications will be rejected.

4.4 As directed by the CQA Officer, samples will be selected at random and sent to the laboratory for conformance testing. The laboratory testing program will be directed by the CQA Officer and include but not be limited to the following properties:

4.4.1 Thickness (ASTM D751)

4.4.2 Density (ASTM D792)

4.4.3 Carbon Black Content (ASTM D1603)

4.4.4 Tensile Properties (ASTM D638)

4.4.5 Tear Resistance (ASTM D1004)

4.4.6 Puncture Resistance (ASTM D4833)

5. The Engineer or CQA Officer may take additional samples for conformance testing from any rolls that are of questionable quality.

6. The Geomembrane Contractor will submit a daily field record to the Engineer. The daily field record will be reviewed and retained by the Engineer. Any discrepancies will be brought to the Geomembrane Contractor's attention immediately.

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7. Overheating of the geomembrane will be monitored by the Engineer or his representative. The locations and repair method of overheated areas will be recorded in the daily field reports. The method of repair will be determined in the field by the Engineer.
8. During seaming, the Engineer or his representative will observe the seams for the following:
 - 8.1 Proper preparation,
 - 8.2 Overheating, and
 - 8.3 Proper distribution of slack.
9. The Engineer or his representative will observe the geomembrane during the coolest part of the day to check for slack. Any areas where "Trampolining" occurs will be marked by the Engineer for repair by the Geomembrane Contractor. In general, anchor trenches should not be backfilled until slack has been established.
10. All pipe boots will be observed by the Engineer or his representative for proper welding technique and existence of slack in the geomembrane.

C. Trial Seams

1. The Geomembrane Contractor will perform a trial seam under the conditions outlined in the Contract Specifications. The trial seam should be approximately 5- ft. long. The Engineer will sample the trial seam from the center 3-ft. of the test sample.

- 1.1 The date, time and equipment, as well as liner temperature, welding temperature, and seaming parameters will be recorded for each trial seam.
 - 1.2 A minimum of three specimens from each sample will be tested in peel (ASTM D413 as modified in NSF 54). Film Tear Bond (FTB) type failures will be the criterion for qualification of the trial seam. Testing will be performed in the field by the Geomembrane Contractor under full-time observation by the Engineer or his representative.
 - 1.3 Untested portions of the trial seam will be retained by the Engineer for the project record and future testing as required.
 - 1.4 All trial seams must pass the field testing before production seaming is performed by the Geomembrane Contractor.
2. The Geomembrane Contractor will obtain samples of field seams, suitable for testing, from the beginning and end of each field run and as directed in the Contract Specifications. These samples may be from areas either to be buried in the anchor trench or covered with another sheet.
 - 2.1 The date, time, equipment seam number, and seaming parameters will be marked on each sample and recorded on a daily geomembrane field summary.

3. Samples retained will be tested in the field by the Geomembrane Contractor. A minimum of two specimens from each sample will be tested in peel. FTB type failures will be the criterion for qualification of the production seam.
4. Should the results of any of the above described tests not meet the physical properties in accordance with the Contract Specifications, the Engineer may require additional samples to be taken from seams performed on that particular half day. Said samples are to be tested for the same properties as described in Paragraph No. C-A.3, above. Depending on the results of these tests, the Engineer will decide on appropriate repair procedures.
5. The Engineer or the County may require additional random samples to be taken for testing in areas which visually appear defective and not in accordance with the Contract Specifications.

D. Non-Destructive Testing

1. The Geomembrane Contractor is responsible for the completion of non-destructive testing of the entire length of all field seams; verifying that the seam is watertight. Testing can be a vacuum test, pressure test, or approved equal, and will be described in writing by the Geomembrane Contractor and approved by the Engineer in advance.
2. Non-destructive testing will be observed by the Engineer or his representative on a full-time basis.

E. Destructive Testing of Production Seams

1. During geomembrane installation, the Engineer will perform additional conformance testing, as required, using the procedures outlined in above.
2. Destructive laboratory testing of seams is the responsibility of the Engineer. A report of all testing is to be provided by the Engineer. The Film Tear Bond (FTB) criteria will be used to qualify a seam. Load and the type of failure will be recorded for each specimen.
3. Destructive seam samples will be laboratory tested by the Engineer. Testing frequency is outlined in the Contract Specifications.
 - 3.1 Test samples will be at least 12 inches by 24 inches in size. A minimum of five die cut peel specimens will be tested for each sample in accordance with ASTM D413 as modified in NSF 54. At least five specimens from each sample will be tested for bonded shear strength in accordance with ASTM D3083 as modified in NSF 54.
 - 3.2 All laboratory specimens will be conditioned for a minimum of one hour prior to testing at the Standard Atmosphere for Testing Geosynthetics, that is, air maintained at a relative humidity of $65 \pm 5\%$ and a temperature of $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$).
 - 3.3 Peel tests will be performed on both seams of a double-hot wedge fusion seam.

4. The load and elongation at failure will be measured for each specimen. FTB is the qualifying criterion.
 - 4.1 The Engineer will describe the type of failure for each specimen and record the presence of any disbonding, delamination, foreign material in the bond area, etc.
 - 4.2 As a general guideline, the bonded shear strength should equal or exceed 90% of the tensile strength (in pounds per unit width) of the parent material.
 - 4.3 As a general guideline, the peel adhesion should exceed 60% of the sheet yield stress of the parent material.
5. For double hot wedge fusion seams, both seams will be tested and are subject to qualification criteria.

VI. Leachate Collection and Removal System

A. Synthetic Drainage Media (SDM)

1. The SDM may be confirmation tested by the Engineer to determine its ability to transmit water in-place (ASTM D4716) under the conditions outlined in the project specifications. Transmissivity test data generated by suppliers will be submitted with bid documents. The results of this test will be submitted to the Engineer for review.

2. Upon delivery to the site, the SDM will be inspected by a representative of the Engineer and compared to bid samples submitted by the General Contractor. All applicable product information will be recorded. The following is a Summary of the documentation that will be submitted by the General Contractor prior to installation:

- 2.1 Hydraulic Transmissivity Test Data (with bid)
- 2.2 Three Synthetic Drainage Media Samples (with bid)
- 2.3 Mill Certificate
- 2.4 Six sets of Field Erection Drawings (if applicable)
- 2.5 Delivery Tickets

3. The Filter Geotextile to be used in the SDM may be confirmation tested to assure conformance with the Contract Specifications. Upon delivery to the site, geotextile will be sampled by the Engineer. Samples will be full roll width and at least five feet long. The inner and outer wraps of the rolls will be excluded from the samples.

3.1 Conformance testing will be performed to assure that the properties of each type of geotextile meet or exceed the requirements outlined in the Contract Specifications. Testing includes but is not limited to the following properties:

- 3.1.1 Mass Per Unit Area (ASTM D3776)
- 3.1.2 Grab Tensile (ASTM D4632)
- 3.1.3 Burst Strength (ASTM D3786)

3.1.4 Puncture Resistance (ASTM D4833)

3.1.5 AOS (ASTM D4751)

3.2 The minimum sampling frequency and tests to be performed will be established in the Contract Specifications.

4. Test data will be submitted to the CQA Officer for review and approval. Any material not conforming to the requirements in the Contract Specifications will be resampled and retested as directed by the CQA Officer. If the retested material fails the conformance testing, the Engineer will recommend rejection of the geotextile lot in question.

5. Rolls of geonet delivered to the site will be inspected by the Engineer or his representative. Randomly selected rolls will be sampled for conformance testing, if applicable. Samples will be at least three feet long by the full roll width.

5.1 Samples submitted for conformance testing will be inspected by the CQA Officer on site. The geonet thickness and aperture will be measured. Samples will be forwarded to the laboratory for additional verification of physical or performance properties, including but not limited to the following:

5.1.1 Density (ASTM D792)

5.1.2 Carbon Black Content (ASTM D1603)

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6. Test data will be submitted to the CQA Officer for review and approval. Any material not conforming to the requirements in the Contract Specifications will be resampled and retested as directed by the CQA Officer. If the retested material fails the conformance testing, the Engineer will recommend rejection of the entire lot of geonet in question.
7. Disqualified or otherwise unsuitable material will be removed from the project site by the General Contractor at no expense to the County.
8. Roll tags or packing lists will be retained for all rolls of geonet and geotextile delivered to the site.
9. Storage and handling conditions for the geonet and geotextile will be observed by the Engineer or his representative. The material should be kept as dry and as free of dirt and debris as possible.
10. Geotextiles should be kept in protective wrapping until installation. Any rolls of geotextile delivered to the site without UV and moisture protection wrapping may be rejected by the Engineer or his representative.
11. Placement and connections for the Synthetic Drainage Media will be observed and recorded by the Engineer or his representative to assure conformation with the Contract Specifications and Manufacturer's recommendation. Any damaged material (including underlying geomembrane) will be

marked for repair or replacement.

B. Natural Drainage Media

1. Prior to placement, a minimum of three samples of Natural Drainage Media will be obtained by the CQA Officer. Gradation Analysis (ASTM D422) will be performed on each sample. Constant head permeability tests may be performed on one representative sample of Natural Drainage Media as directed by the Engineer.

C. Drainage Pipe

1. Manufacturer's technical data shall be provided to the Engineer by the supplier. The literature will be retained by the Engineer.
2. A minimum 1-foot long specimen of each solid and perforated pipe of each pipe size will be retained by the Engineer.
3. Connections for drainage pipe will be observed by the Engineer or his representative for any holes or burrs in the weld that may potentially damage the geomembrane.
4. The length and location of each collector pipe will be recorded prior to placement of overlying material.

D. Sump Areas

1. The leachate standpipe, base and bearing plates will be visually inspected by the Engineer or his representative prior to placement to assure that they are smooth and free of burrs or sharp edges which may potentially damage the geomembrane.
2. The sump areas will be observed to check for sharp or other potentially damaging objects prior to placement of the riser and geomembrane protection. The sump areas will be cleaned by the Geomembrane Contractor prior to observations by the Engineer or his representative.
3. The Engineer or his representative will verify the proper geomembrane protection has been provided by the General Contractor before the riser assembly is placed in the sump area.
4. A hydraulic test of the sump areas may be performed by the Engineer prior to placement of the riser assembly if deemed necessary.

VII. OPERATION COVER

A. Placement of Operational Cover Fill

1. The height of the Operational Cover placed will not exceed the elevations shown on the Contract Drawings. The height of the

Operational Cover will be measured by the Engineer or his representative.

2. Each load of fill will be visually examined at the source or at the Cell itself. Any evidence of material that does not conform to the Contract Specifications will be removed.
3. Placement will be monitored to assure that the minimum soil buffer between spreading and hauling equipment and the geomembrane is maintained.

VIII. DATA BASE MANAGEMENT

1. The results of the grain size, Atterberg Limits, modified Proctor, moisture content, field density, and laboratory permeability tests will be compiled and maintained on-site.
2. Statistical analyses, including mean and standard deviation, will be performed on data for each soil type used for Compacted Soil Liner construction. The analyses will be made for physical properties (limits, grain size, maximum dry density) and field compaction results. These analyses will be updated bi-weekly during the period of active fill placement.
3. Statistical analyses will be performed on all geosynthetics conformance test data.

4. Statistical analyses will be performed for the laboratory destructive testing for geomembrane production seams. The mean, range and standard deviation for stress at yield will be recorded for peel and shear data.

IX. AS-BUILT CONDITIONS

1. The finished lines and grades of the surface of the Existing Conditions, Excavation, Compacted Embankment, Compacted Soil Liner, and Operational Cover will be presented by the Engineer.
2. A drawing showing the location and identifying number of the geomembrane panels, seam and destructive samples will be maintained and updated by the Engineer. This does not replace the required Panel Layout As-Built to be submitted by the Geomembrane Contractor. The Engineer's layout drawing will be used to check the drawing submitted by the Geomembrane Contractors.
3. Details showing Synthetic Drainage Media connections will be submitted.
4. As-built location and details for construction of the Leachate Collection and Removal System will be submitted.

CQA SUBMITTAL

1. The Construction Certification document will contain the results of all tests performed on the following components, where applicable:

- 1.1 Compacted Embankment,
- 1.2 Compacted Soil Liner,
- 1.3 Synthetic and natural drainage media,
- 1.4 Geomembrane material and installation,
- 1.5 Operational Cover,
- 1.6 Leachate Removal and Discharge System, and
- 1.7 Other elements of construction incorporated into one Cell.

2. Record drawings will be included with the CQA document.

-Booklet-

42-04

Halifax County Coal Ash Monofill
Cell 2 Expansion

Halifax County, North Carolina

May 17th, 1996

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director



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13-04

May 17, 1996

Mr. Neal C. Phillips, Manager
Halifax County
P. O. Box 38
Halifax, North Carolina 27839

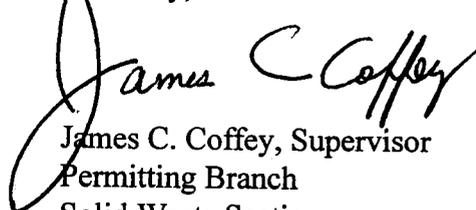
Re: Approval to Construct
Halifax County Ash Monofill - Cell 2
Permit No. 42-04

Dear Mr. Phillips:

The Solid Waste Section hereby approves the design modifications proposed by Hazen and Sawyer and issues approval to construct Cell 2 of the Halifax County Ash Monofill. Construction of Cell 2 shall be in accordance with the conditions of the Permit to Construct originally issued for the facility on 5/12/93. Construction Condition No. 3 describes the pre-operative requirements which must be met in order to obtain permission to operate Cell 2.

If you have any questions or comments regarding this approval, please contact me at (919) 733-0692, ext. 259.

Sincerely,


James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: John Bove, Hazen and Sawyer
Terry Dover
Ben Barnes
Jim Barber

**HALIFAX COUNTY COAL ASH MONOFILL
CELL 2 EXPANSION
HALIFAX COUNTY, NORTH CAROLINA**

PROJECT SPECIFICATIONS

**HAZEN AND SAWYER, P.C.
JANUARY, 1996**

APPROVED
DIVISION OF SOLID WASTE MANAGEMENT
DATE 5/17/96 BY SLC

SECTION 2C
EARTHWORK

PART 1 - GENERAL

1.01 Work Included

Furnish all labor, equipment and materials required to complete all work associated with excavation, including off site borrow, dewatering, sealing, discing, drying, undercutting, backfill, foundation and backfill stone, embankments, stockpiling topsoil and any excess suitable material in designated areas, in place compaction of embankments, backfill and subgrades beneath foundations and roadways, shoring and bracing, disposing from the site all unsuitable materials, site grading and preparation of pavement and structure subgrade, and other related and incidental work as required to complete the work shown on the Contract Drawings and specified herein.

The work shall include, but not be limited to:

1. Excavation of soil and rock to the lines and grades shown on the Contract Drawings,
2. Stockpiling excavated materials suitable for use in construction at on-site locations designated by the Owner and shown on the Contract Drawings,
3. Construct perimeter containment berms using suitable excavated on-site soils and preparing the surface for geomembrane installation,
4. Excavate soil for piping outside the containment berms as required by the Contract Drawings and backfill using the materials shown on the Contract Drawings,
5. Place and compact on-site soils for permanent access roads,
6. Dewater and maintain all excavations and the surface of all grading and earthwork,
7. Provide required submittals,
8. Perform all surveys necessary to establish and verify lines and grades for all earthwork, including cuts, fills, general grading and pipe excavations.

All excavations shall be in conformity with the lines, grades, and cross sections shown on the Contract Drawings or established by the Engineer.

It is the intent of this Specification that the Contractor conduct the construction activities in such a manner that erosion of disturbed areas and off site sedimentation be absolutely minimized. Required erosion and sediment control shall be as outlined in Section 2J.

1.02 Related Work

Related Contract Work is described in the following Section(s) of the Specifications:

<u>Work</u>	<u>Section</u>
Site Preparation	2A
Demolition and Removals	2B
Geomembrane	2F
Erosion Control, Final Grading and Landscaping	2J

1.03 Testing and References

The current editions and addenda of the following publications are made part of the Specifications and are applicable to the extent indicated by the specific reference. Testing performed shall conform to the following applicable standards:

1. North Carolina Department of Transportation (NCDOT)
Standard specifications for Aggregates.

2. American Society for Testing and Materials (ASTM):

ASTM C 127	Test for Specific Gravity and Absorption of Coarse Aggregate.
ASTM C 136	Test for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D 422	Particle Size Analysis of Soils.
ASTM D 423	Test for Liquid Limit of Soils.
ASTM D 424	Test for Plastic Limit and Plasticity Index of Soils.
ASTM C 535	Test for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM D 698	Standard Method of Test for the Moisture - Density Relations of Soils Using a 5.5 lb. (2.5 kg) Rammer and a 12-inch (305 mm) Drop.

ASTM D1556	Test for Density of Soil in Place by the Sand-Cone Method.
ASTM D1557	Test for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lbs. (4.5 kg) Rammer and 18-inch (457 mm) Drop.
ASTM D2049	Test Method for Relative Density of Cohesionless Soils.
ASTM D2167	Test for Density of Soil in Place by the Rubber-Balloon Method.
ASTM D2216	Test for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
ASTM D2487	Test for Classification of Soils for Engineering Purposes.
ASTM D2922	Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.04 Submittals

In accordance with the procedures and requirements set forth in the General Conditions and Division 1, the Contractor shall submit the following:

1. Name and location of all material suppliers.
2. Certificate of compliance with the standards specified above for each source of each material.
3. List of disposal sites for waste and unsuitable materials and all required permits for use of those sites.
4. Plans of open cut excavations showing side slopes and limits of the excavation at grade.
5. Submit descriptive information on compaction equipment to be used for construction of the embankment and appurtenant structures. The data shall include type of equipment, manufacturer, model number, axle weights, tire inflation pressure, and other descriptive information. Also submit descriptive information on proposed earth moving equipment and a schedule for the work.

6. Location and source of off site borrow material to be used as embankment, embankment reconstruction and backfill, where applicable.

7. Dewatering procedures.

1.05 Product Handling

Soil and rock material shall be excavated, transported, placed, and stored in a manner so as to prevent contamination, segregation and excessive wetting. Materials which have become contaminated or segregated will not be permitted in the performance of the work and shall be removed from the site or otherwise disposed of as directed by the Owner.

1.06 Use of Explosives

Blasting shall not be conducted within 1000 feet of the proposed landfill limits, except where approved by the Engineer and the Owner at least two weeks in advance.

When the use of explosives is necessary for the prosecution of the work, the Contractor shall exercise the utmost care not to endanger life or property. The Contractor shall be responsible for any and all damage or injury to persons or property resulting from the use of explosives.

All explosives shall be stored in a secure manner, in compliance with all laws, and all such storage places shall be marked clearly "DANGEROUS EXPLOSIVES".

The Contractor shall notify each public utility company having facilities in close proximity to the site of the work of his intention to use explosives. This notice shall be given sufficiently in advance to enable the utility companies to take whatever steps they may consider necessary to protect their property from injury. The Contractor shall also give the Engineer, all occupants of adjacent property, and all other Contractors working in or near the Project, notice of his intention to use explosives.

The Contractor shall submit a blasting plan to the Engineer within 24 hours after each shot. The blasting plan shall contain the full details of the drilling and blasting patterns unless otherwise approved by the Engineer, and shall contain the following information: (1) station limits of shot, (2) plan of drill hole pattern, blast hole spacing, blast hole diameters and free face, (3) initiation sequence of blast holes including delay timer and delay system, (4) manufacturers

data sheet for all explosives, primers, and initiators employed, (5) loading diagram showing type and amount of explosives, primers, initiators, and location and depth of stemming. The blasting plan submitted is for quality control and record keeping purposes. Review by the Engineer shall not relieve the Contractor of his responsibilities as provided herein.

PART 2 - MATERIALS

2.01 Rock

Any material occupying an original volume of at least one cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having minimum draw bar pull rated at not less than 56,000 pounds (Caterpillar D 8K, D9 or equivalent) or by a Caterpillar 977 front-end loader or equivalent. Excavation of material with larger equipment will be paid as Earth excavations unless Contractor demonstrates inability to excavate with above specified equipment.

2.02 Compacted Embankment

A. Soils from the excavations capable of being compacted to the specified densities, with the exceptions of topsoil and organic material, meeting the requirements stipulated in Paragraph B below, may be used as select fill for backfilling, constructing embankments and for roadway subgrades. Compacted embankment materials shall be compacted at a moisture content satisfactory to the Engineer, which shall be approximately that required to produce the maximum density except that the moisture content shall not be more than 1% below nor more than 6% above the optimum moisture content for the particular material tested as determined by ASTM D698. The Contractor shall dry or add moisture to the compacted embankment material when required to provide a uniformly compacted and stable embankment. When air drying of excavated material is necessary, the Contractor may spread, disc, windrow, etc. as necessary at locations on site as directed by the Engineer. Where excavated material does not meet the requirements specified herein for select fill, the Contractor shall furnish off site borrow material meeting the specified requirements for select fill at no additional expense to the Owner. Fill material borrowed off site shall be of a nature meeting the requirements stipulated herein.

B. The Compacted Embankment shall consist of on-site, clean natural soil classified as SM, SP, SC, ML, CL-

ML, or CH using the Unified Soil Classification System (USCS) containing no topsoil or other deleterious material.

The Compacted Embankment shall be placed in maximum 10-inch thick horizontal lifts (loose measure) and shall be compacted to a density of at least 95% maximum standard dry density (ASTM D 698). Rock fragments, cobbles and boulders shall not exceed 3 inches in any dimension.

2.03 Crushed Stone, Screened Gravel or ABC

Crushed stone or screened gravel shall be used for pipe bedding, foundation material and/or drainage layers beneath structures, ground under drains and wherever else shown on the Contract Drawings and specified herein. ABC shall be used where indicated on the Contract Drawings or as specified herein.

1. For Subgrade Preparation at Structures - The foundation material shall meet the requirements of Aggregate Standard Size No. 57, No. 67, or ABC, as defined by the North Carolina Department of Transportation (NCDOT) Standard Specifications, Latest Edition unless noted otherwise on the Contract Drawings or specified herein. Unless otherwise stated herein or shown on the Contract Drawings, all mat foundations (bottom slabs) for the proposed structures shall have a blanket of crushed stone 6-inches thick minimum placed directly beneath the proposed mat. The blanket shall extend a minimum of 12 inches beyond the extremities of the mat. Note: ABC shall be used where specifically specified on the Contract Drawings, otherwise No. 57 or No. 67 shall be used.
2. For Ground Under Drains and Pipe Bedding - The coarse aggregate shall meet the requirements of Aggregate standard size No. 57 or No. 67, as defined by NCDOT Standard Specifications. The thickness of the stone shall be as indicated on the Contract Drawings.

PART 3 - EXECUTION

3.01 Stripping of Topsoil

In all areas within the clearing limits shown on the Contract Drawings, the topsoil shall be stripped and shall be deposited in storage piles on the site, at locations designated by the Engineer. Topsoil shall be kept separated from other excavated materials and shall be piled free of roots and other undesirable materials.

Topsoil shall be considered the surface layer of soil and sod, suitable for use in seeding and planting. It shall contain no debris, refuse or any material toxic to plant growth.

3.02 Excavation

- A. All soil material excavated, regardless of its nature or composition, shall be classified as UNCLASSIFIED EXCAVATION. Excavation shall include the removal of all soil, weathered rock, boulders, conduits, pipe, and all other obstacles encountered and shown to be removed within the limits of excavation shown on the Contract Drawings or specified herein. The cost of unclassified soil excavation shall be included in the Lump Sum Bid Price and no additional payment will be made for the removal of obstacles encountered within the excavation limits shown on the Contract Drawings and specified herein.

Sand and/or gravel layers encountered within the containment area shall be overexcavated as directed by the Engineer.

- B. Rock excavation includes materials encountered that meet the definition of rock presented in Section 2.01 of these specifications. The cost of rock excavation, if any, shall be paid on the basis of the Unit Price Bid for Rock Excavation.

No rock shall be removed prior to authorization by the Owner or Engineer. Where rock is encountered above design subgrade elevations, rock shall be removed to approximately 3 feet below the lines and grades indicated on the excavation plans as approved by the Engineer.

The subgrade will be brought back up to grade by placing Compacted Embankment as described in Section 3.06 of these Contract Specifications.

- C. When authorized by the Owner and the Engineer, blasting operations shall be conducted in accordance with all existing ordinances and regulations. All structures shall be protected from the effects of the blast. The blasting shall be done by experienced workmen. Dispose of excavated rock in accordance with applicable local, state, and federal regulations.

Any damage done shall be promptly repaired by the General Contractor at his expense. Storage of explosive materials on the site will not be permitted.

A licensed blaster shall conduct all blasting operations, and no shot shall be fired without his approval.

When conducting blasting operations within one hundred fifty feet of an uninhabited structure or within three hundred feet of any inhabited structure, copies of a pre-blast survey shall be furnished to the Engineer prior to commencement of work. This survey should include noting and photographing of any existing cracks or other irregularities. In addition, all blasts within the above distances shall be monitored with a direct reading velocity seismograph. At the immediate location of an uninhabited structure the maximum peak particle velocity shall not exceed two inches per second. At the immediate location of an inhabited structure the maximum peak particle velocity shall not exceed one inch per second.

Copies of all blasting and seismograph reports, on forms acceptable to the Division Of State Fire Marshal, shall be submitted to the Engineer within three working days of each blast.

- D. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders, and at such other places as may be indicated on the plans or directed by the Engineer. No excavation shall be wasted except as may be permitted by the Engineer. The Engineer will designate materials that are unsuitable. The Contractor shall furnish off site disposal areas for the unsuitable material. Where suitable materials containing excessive moisture are encountered above grade in cuts, the Contractor shall construct above grade ditch drains prior to the excavation of the cut material when in the opinion of the Engineer such measures are necessary to provide proper construction.
- E. 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. Excavation shall be made in accordance with the grades and details shown on the Contract Drawings and as specified herein.
- F. Excavation slopes shall be flat enough to avoid slides that will cause disturbance of the subgrade or damage of adjacent areas. Excavation requirements and slopes shall be as indicated in the Contract Drawings. The Contractor shall intercept and collect surface runoff both at the top and bottom of cut slopes. The

intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded as shown on the Contract Drawings or as may be directed by the Engineer. Concurrent with the excavation of cuts, the Contractor shall construct intercepting berm ditches or earth berms along and on top of the cut slopes at locations shown on the Contract Drawings or designated by the Engineer. All protruding roots and other objectionable vegetation shall be removed from slopes. The Contractor shall be required to submit plans of open-cut excavation for review by the Engineer before approval is given to proceed.

- G. The bottom of all excavations for structures and pipes shall be examined by the Engineer for bearing value and the presence of unsuitable material. If, in the opinion of the Engineer, additional excavation is required due to the low bearing value of the subgrade material, or if the in-place soils are soft, yielding, pumping and wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted select fill, or material directed by the Engineer. Payment for such additional work ordered by the Engineer shall be made as an extra by a Change Order in accordance with the General Conditions and Division 1. No payment will be made for subgrade disturbance caused by inadequate dewatering or improper construction methods.

Any areas excavated below design subgrade elevations by the Contractor, unless directed by the Engineer, shall be brought back to design elevations at no cost to the County. The Contractor shall place and compact such material in accordance with Section 3.06- Compacted Embankment of these Contract Specifications.

At the direction of the Engineer or County, the General Contractor may be required to leave designated portions of the subgrade above design elevations a distance of 6 to 12 inches in order to protect the subgrade against erosion or other damage. Such areas shall be trimmed to design elevations just prior to placement of the overlying material.

- H. 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 and acceptance by the Engineer.

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. 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.

- I. The Contractor shall protect finished lines and grades of completed excavation against excessive erosion, damage from trafficking or other causes.

3.03 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. 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 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 except as indicated herein. The Engineer may permit sheetings to be left in place at the request and expense of the Contractor. The Engineer may order certain sheetings left permanently in place in addition to that required by the Contract. The cost of the materials so ordered left in place, less a reasonable amount for the eliminated expense of the removal work omitted, will be paid as an extra by a Change Order in accordance with the General Conditions and Division 1. Any sheeting or bracing left in place shall be cut off at least two (2) feet below the finished ground surface or as directed by the Engineer.

3.04 Protection of Subgrade

To minimize the disturbance of bearing materials and provide a firm foundation, the Contractor shall comply with the following requirements:

- A. Use of heavy rubber-tired construction equipment shall not be permitted on the final subgrade unless it can be demonstrated that drawdown of groundwater throughout the entire area of the structure is at least 2 feet below subgrade. Even then, the use of such equipment shall be prohibited should subgrade disturbance result from concentrated wheel loads.
- B. Subgrade soils disturbed through the operations of the Contractor shall be excavated and replaced with compacted select fill at the Contractor's expense as directed by the Engineer.
- C. The Contractor shall provide positive protection against penetration of frost into materials below the bearing level during work in winter months.

3.05 Dewatering

The Contractor shall do all dewatering as required for the completion of the work. Procedures for dewatering proposed by the Contractor shall be submitted to the Engineer for review prior to any earthwork operations. All water removed by dewatering operations shall be disposed of in accordance with the North Carolina Sedimentation Pollution Control Act.

The dewatering system shall be of sufficient size and capacity as required to control groundwater or seepage to permit proper excavation operations, embankment construction and reconstruction, subgrade preparation, and to allow concrete to be placed in a dry condition. The system shall include a sump system or other equipment, appurtenances and other related earthwork necessary for the required control of water. The Contractor shall drawdown groundwater to at least 3 feet below the bottom of excavations at all times in order to maintain a dry and undisturbed condition.

The Contractor shall control, by acceptable means, all water regardless of source. Water shall be controlled and its disposal provided for at each berm, structure, etc. when necessary. The entire periphery of the excavation area shall be ditched and diked to prevent water from entering the excavation where applicable. The Contractor shall be fully responsible for disposal of the water and shall provide all necessary means at no additional expense to the Owner. The Contractor shall be solely responsible for proper design, installation, proper operation, maintenance, and any failure of any component of the system.

The Contractor shall be responsible for and shall repair without cost to the Owner, any damage to work in place

and the excavation, including damage to the bottom due to heave and including removal of material and pumping out of the excavated area. The Contractor shall be responsible for damages to any other area or structure caused by his failure to maintain and operate the dewatering system proposed and installed by the Contractor.

The Contractor shall take all the steps that he considers necessary to familiarize himself with the surface and subsurface site conditions, and shall obtain the data that is required to analyze the water and soil environment at the site and to assure that the materials used for the dewatering systems will not erode, deteriorate, or clog to the extent that the dewatering systems will not perform properly during the period of dewatering. Copies of logs of borings and laboratory test results are available to the Contractor. This data is furnished for information only, and it is expressly understood that the Owner and Engineer will not be held responsible for any interpretations or conclusions drawn therefrom by the Contractor.

Prior to the execution of the work, the Contractor, Owner and Engineer shall jointly survey the condition of adjoining structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

3.06 Compacted Embankment

- A. Compacted Embankment is the on-site compacted fill that provides the foundation and the berms for the containment area, as well as the subgrade for some access roadways. Areas defined as Compacted Embankment are indicated on the Contract Drawings.
- B. Surfaces upon which compacted embankment is to be constructed shall be stripped of topsoil, organic material, rubbish and other extraneous materials.
- C. Prior to placement of Compacted Embankment, the exposed subgrade shall be proofrolled using a loaded pan, dump truck or other suitable equipment in the presence of the Engineer or his representative. Any soft or unsuitable materials revealed before or during the in place compaction shall be removed as directed by the Engineer and replaced with Compacted Embankment.
- D. Surfaces on which Compacted Embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the Compacted Embankment

with the existing surface. The Compacted Embankment soils shall be as specified under Paragraph 2.02, Compacted Embankment, and shall be deposited and spread in successive, uniform, approximately horizontal layers not exceeding 12-inches loose measure or 8-inches in compacted depth for the full width of the cross section, and shall be kept approximately level by the use of effective spreading equipment. Hauling shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form during the construction of the embankment. The embankment shall be properly drained at all times. Each layer of the embankment shall be thoroughly compacted to the density specified under Paragraph 3.09, Compaction.

- E. The Compacted Embankment shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation when necessary to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content.
- F. Quality Assurance during placement of the Compacted Embankment shall be provided by the Engineer and paid for by the Owner. The frequency of field compaction tests shall be determined by the Engineer. No fill or compaction work shall be performed unless the Engineer or his representative is present on the project site and is informed of the intent to perform such work. The Contractor shall cooperate with the Engineer or his representative when compaction or other required tests are taken and make adjustments, as requires, in the filling and compacting operations to meet the compaction specifications. If the compaction test results do not meet the specified requirements, the Contractor shall add water or dry the material, as may be necessary and continue compaction to achieve the compaction requirements, at his own expense.

The exposed surface of Compacted Embankment shall be rolled with a flat drum roller at the end of each work day to protect from adverse weather conditions.

- G. Where embankments are to be placed and compacted on slopes, or when embankment is built on the slopes that are steeper than 4:1, the subgrade shall be benched to a minimum depth of 6 inches and the Compacted Embankment shall be placed in horizontal lifts.

3.07 Preparation of Geomembrane Subgrade

A. The surfaces of the Compacted Embankment or excavated subgrade to be lined with geomembrane shall be free of roots or other deleterious material, sharp objects, or debris. Such materials shall be removed from the subgrade surface prior to geomembrane installation. Embedded, nonprotruding smooth rocks or stones may remain in place on the soil liner surface, unless otherwise directed by the Engineer. The subgrade surface shall provide a firm, unyielding foundation for the geomembrane with no sudden or abrupt changes or breaks in grade. Geomembrane shall not be installed over subgrade containing standing water, frost, excessive moisture, or on subgrade exhibiting evidence of deep rutting from construction equipment wheels or tracks.

B. The soil surfaces to be lined with geomembrane, including slopes 3-horizontal to 1-vertical or gentler, shall be rolled and sealed with a smooth drum compactor. All geomembrane subgrade shall be approved by the Engineer prior to geomembrane placement.

Slopes steeper than 3-horizontal to 1-vertical that will be lined with geomembrane shall be prepared by raking or other method approved by the Engineer.

The General Contractor shall maintain the subgrade surface until installation of the geomembrane is complete. Temporary covering of the bottom may be required prior to installation of the geomembrane.

C. Surfaces not properly maintained shall be repaired by the General Contractor at no cost to the Owner. A suitable surface for geomembrane construction shall be a surface at a specified compaction and moisture content criteria provided in these Contract Specifications.

D. Locations of control stakes in the subgrade areas to be covered with geomembrane shall be scarified to the depth that the stakes were driven and recompact to the requirements outlined in Section 3.09 for Compacted Embankment.

E. For Compacted Embankment placed for berm construction, the Engineer may require that the Compacted Embankment be overbuilt a distance of approximately 6 inches to protect against erosion or other damage. Such overbuilt areas shall be trimmed just prior to placement of geomembrane.

3.08 Backfilling for Structures and Piping

- A. All structures and pipes shall be backfilled with the type of materials shown on the Contract Drawings and specified herein. Select fill shall be deposited in successive, uniform, approximately horizontal layers not exceeding 8-inches in compacted depth for the full width. Stones or fragmentary rock larger than 4-inches in their greatest dimension will not be allowed within the top 1-foot of the final grade. No stone or fragmentary rock larger than 12-inches in their greatest dimension will be allowed for any portion of backfill. Compaction shall be in accordance with the requirements of Paragraph 3.09, Compaction.
- 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.

3.09 Compaction

The Contractor shall compact Compacted Embankment, general select fill, backfill, crushed stone and in place subgrade in accordance with the requirements of this Section. The densities specified herein refer to percentages of maximum density as determined by the noted test methods. Compaction of materials on the project shall be in accordance with the following schedule:

	Required % std. Proctor (ASTM D698)	Moisture Content Range (ASTM D698)*	Max. Lift Thickness as Compacted Inches
Compacted Embankment	95	-1 to +6	8
Embankments Beneath Structures**	98	N/A	8
Backfill Around Structures	95	N/A	8
Backfill in Pipe Trenches	95	N/A	6

- * Range refers to the percent of in-place moisture content greater than optimum moisture content (+) or lower than optimum moisture content (-).
- ** Embankments 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.

Field density tests will be made by the Engineer to determine if the specified densities have been achieved, and these tests shall be the basis for accepting or rejecting the compaction. In-place density tests will be performed in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. The Engineer will be the sole judge as to which test method will be the most appropriate. Failure to achieve the specified densities shall require the Contractor to re-compact the material or remove it as required. The Contractor shall, if necessary, increase his compactive effort by increasing the number of passes, using heavier or more suitable compaction equipment, or by reducing the thickness of the layers. The Contractor shall adjust the moisture contents of the soils to bring them within the optimum range by drying them or adding water as required.

3.10 Site Grading

All disturbed areas 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.

3.11 Unauthorized Excavation

Whenever the excavation is carried beyond or below the lines and grades shown on the Contract Drawings, the Contractor shall immediately, and at no cost to the Owner, refill such excavated space in accordance with the requirements specified in this Section.

3.12 Removal of Excess and Unsuitable Materials

- A. The Contractor shall remove and dispose of off site all unsuitable materials. Within thirty (30) consecutive days after Notice to Proceed, the Contractor shall submit to the Engineer for review all required permits and a list of disposal sites for the unsuitable materials. If the disposal site is located on private property, the submittal shall also include written permission from the owner of record.
- B. All unsuitable materials shall be disposed of in locations and under conditions that comply with federal, state and local laws and regulations.
- C. The Contractor shall obtain an off site disposal area prior to beginning demolition or excavation operations.
- D. Any surplus excavated material not used for backfilling or embankment suitable for reuse shall be deposited on-site in the disposal area indicated on the Contract Drawings. This area may also be used by the Contractor for spreading and drying any excavated material suitable as select fill that is too wet for use immediately after being excavated. The Contractor shall maintain the earth surfaces of the disposal area, both during the work and until the completion of all seeding and mulching or other erosion control measures specified, in a manner which will effectively control erosion and sedimentation.

The Contractor shall clear and grub the disposal site prior to any excavation work.

- 1. Earth waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practical, but in no case will slopes steeper than 3 horizontal to 1 vertical be permitted.
- 2. Seeding and mulching shall be performed over all the earth waste area. The work of seeding and mulching shall be performed in accordance with Section 2J, Erosion Control, Final Grading and Landscaping.
- 3. The Engineer shall have the authority to establish whatever additional requirements may be necessary to insure the satisfactory appearance of the completed work.

PART 4 - MEASUREMENT AND PAYMENT

4.01 Payment

All work described in this section and required for completion of the work shall be included for payment in the Contractor's Lump Sum Price, Pay Item No. 1, except for the following items:

- A. Unclassified Soil Excavation - Payment quantities for Unclassified Soil Excavation shall be paid for on the basis of the Unit Price Bid for Unclassified Soil Excavation, Pay Item No. 3, per cubic yard removed.
- B. Rock Excavation - Payment quantities for material that meets the definition for rock contained in these specifications shall be on the basis of the Unit Price Bid for Rock Excavation, Pay Item No. 4, per cubic yard removed.
- C. Compacted Embankment - Payment quantities for placement of Compacted Embankment shall be on the basis of the Unit Price Bid for Compacted Embankment, Pay Item No. 5, per cubic yard in-place.

4.02 Measurement

- A. Payment quantities shall be determined by the Contractor and verified by the Engineer. Payment quantities shall not include work performed outside the limits shown on the Contract Drawings unless approved in advance by the Engineer.
- B. Payment quantities for excavation shall not include repair of subgrade that has been approved by the Engineer but has become unsuitable due to excessive moisture, freezing, damage caused by construction traffic or other causes.
- C. Payment quantities for Compacted Embankment shall not include unsuitable material removed and replaced by the Contractor or Compacted Embankment placed to repair unsuitable subgrade outlined in Paragraph 4.02B above.

* * * *

SECTION 2J
EROSION CONTROL, FINAL GRADING AND LANDSCAPING

PART 1 - GENERAL

1.01 Work Included

Furnish all labor, equipment, and materials necessary for erosion control, final grading, seeding, and miscellaneous site work not included under other Sections, but required to complete the work as shown on the Contract Drawings and specified herein. Under this Section, all areas disturbed by construction activities, excavation, materials storage, temporary roads, etc., shall be protected by erosion control measures and reseeded as specified herein.

It is the intent of this Specification that the Contractor conduct the construction activities in such a manner that erosion of disturbed areas and off site sedimentation be absolutely minimized.

All work under this Contract shall be done in conformance with and subject to the limitations of the North Carolina Rules and Regulations for Erosion and Sedimentation Control as adopted by the North Carolina Sedimentation Control Commission (15 NCAC, Chapter 4).

The following excerpts from the regulations are particularly important:

- 1) ...slopes left exposed will, within 30 working days of completion of any phase of grading, be planted or otherwise provided with ground cover, devices, or structures sufficient to restrain erosion...(Section 6b)
- 2) ...a ground cover sufficient to restrain erosion must be planted or otherwise provided within 30 working days on that portion of the tract (disturbed area) upon which further active construction is not being undertaken...(Section 6c)

Erosion and sedimentation controls applicable to this project shall include but not be limited to the following items of work:

1. Permanent sediment basins shall be constructed at locations shown on the Contract Drawings and at other locations directed by the Engineer.
2. Temporary diversion ditches shall be constructed adjacent to disturbed areas as shown on the Contract

Drawings to collect surface runoff from disturbed areas and direct the runoff to the temporary sediment basins. All such temporary diversion ditches shall terminate with temporary sediment basins or filter berm basins as shown on the Contract Drawings.

3. Erect silt fence at locations shown on the Contract Drawings and at other locations directed by the Engineer.
4. Provide temporary or permanent ground cover adequate to restrain erosion on erodible slopes or other areas that will be left unworked for periods exceeding 30 calendar days.
5. The Contractor shall be responsible for developing suitable erosion control measures for all off site waste and borrow areas to the satisfaction of the Engineer. The Contractor is also advised that off site borrow areas more than one acre in size shall comply with all provisions of N.C. Mining Act.
6. Construct 50 foot gravel buffers at entrances from public roads to all unpaved access roads used by the Contractor. The Contractor shall maintain the gravel buffers for the Contract duration or until final pavement, where applicable, has been constructed.
7. Provide other types of erosion and sedimentation control devices at the locations shown on the Contract Drawings, or as specified herein.

1.02 Contractor's Responsibilities

Furnish and submit certification for the materials used as specified in the General Conditions, Division 1 and Division 2.

PART 2 - MATERIALS

2.01 Permanent Sediment Basins

Permanent sediment basins shall be constructed at locations shown on Contract Drawings and specified herein. Basins shall be constructed before or as soon as practical after any clearing activities begin and before any construction activities may begin. The permanent basins shall be maintained to the satisfaction of the Engineer until the site has been stabilized. Proper maintenance shall include, but not be limited to, the periodic removal and proper disposal of trapped sediments

and clearing of obstructions from the principal and emergency spillways.

2.02 Silt Fence

Silt fences shall be erected as shown on the Contract Drawings and specified herein. The silt fences shall be erected and maintained to the satisfaction of the Engineer until a vegetative ground cover has been established. Proper maintenance shall include, but not be limited to, the periodic removal of trapped sediments and replacement of the filter fabric should it deteriorate to a point that in the opinion of the Engineer it will no longer provide an adequate runoff filter. Replacement of the filter fabric, if required by the Engineer, will be at the Contractor's expense.

Posts: Posts for silt fence shall be steel and shall have the following properties:

ASTM Designation: ASTM 702
Length: 5-Foot Long (T-Type)
Weight: 1.25#/Foot (min.)
Area of Anchor Plate: 14 Sq. In.

Note: Five (T) Fasteners shall be furnished with each post.

The filter geotextile shall conform to the requirements outlined in Section 2G of these specifications.

Filter Fabric: Filter Fabric for the silt fence shall have the following minimum properties:

Filter fabric shall be a woven geotextile made specifically for sediment control. Filter fabric shall not rot when buried and shall resist attack from soil chemicals, alkalies and acids in the PH range from 2 to 13, and shall resist damage due to prolonged ultraviolet exposure.

	<u>Value</u>	<u>Test Method</u>
Weight	2.8 oz/yd ²	ASTM D3776
Grab Tensile Strength	120 lbs	ASTM D4632
Grab Elongation	23%	ASTM D4632
Trapezoid Tear Strength	65 lbs	ASTM D4533
Mullen Burst Strength	310 lbs	ASTM D3786
Puncture Strength	75 lbs	ASTM D3787

Retained Strength
(500 hrs. accelerated
UV exposure)

90%

ASTM D4355

Height

36 inches

After the completion of the project, the Contractor shall remove all silt fence in areas where a good stand of grass has been established and erosion is no longer evident. Removal of the remainder of the silt fence shall occur as other areas are established. Removal of silt fence shall be permitted only with the prior approval of the Engineer.

The Engineer may direct the Contractor to erect and maintain silt fence at other locations not shown on the Contract Drawings. Payment for this work shall be at the unit price bid for this item.

2.03 Filter Geotextile

The Filter Geotextile shall conform to the requirements outlined in Section 2G of the Contract Specifications.

During all periods of shipment and storage, the Filter Geotextile shall be wrapped in heavy-duty protective covering which will protect it from sunlight, mud, dust, dirt, and debris. The Filter Geotextile shall not be exposed to temperatures greater than 140°F. After the protective covering has been removed, the Filter Geotextile shall not be left uncovered under any circumstances for longer than three (3) days.

Each roll of Filter Geotextile will be visually inspected by the Engineer or his representative. The Engineer reserves the right to sample and test at any time and reject, if necessary, any material based on visual inspection or verification tests.

Filter Geotextile shall be installed in such a manner that all splice joints are provided with a minimum overlap of 12-inches. Field splices shall be anchored with anchor pins to insure that required overlap is maintained. At the time of installation, the fabric will be rejected if it has defects, rips, holes, flaws, deteriorations, or damage incurred during manufacture, transportation, or storage.

Backfilling operations shall be done so as to prevent damage to the Filter Geotextile. Damaged sections of Filter Geotextile shall be replaced at no cost to the Owner.

Installation of geotextile shall be done in a manner so as not to rupture, tear, puncture, cut, or abrade the materials. Where such damage occurs, it shall be repaired with a patch which extends at least 18 inches beyond the edge of the damaged area.

2.04 Temporary Sediment Basins

Temporary sediment basins shall be constructed as shown on the Contract Drawings and as specified herein. The temporary sediment basins shall be constructed and maintained to the satisfaction of the Engineer until a vegetative ground cover has been established. Proper maintenance will include, but not be limited to, the periodic removal of trapped sediments. The cost of the temporary sediment basins shall include the excavation, grading, diversion ditches, stone for erosion control, washed stone, geotextile, etc. and all maintenance activities required.

The Engineer may direct the Contractor to erect and maintain temporary sediment basins at other locations not shown on the Contract Drawings. Payment for this work shall be at the unit price bid for this item.

2.05 Gravel and Rip-Rap Filter Berm Basins

Gravel and rip-rap filter berm basins shall be constructed as shown on the Contract Drawings and as specified herein. The filter berm basins shall be constructed at the upstream end of all culverts as indicated and maintained to the satisfaction of the Engineer until the site has been stabilized. Proper maintenance will include, but not be limited to, the periodic removal and proper disposal of trapped sediments. The cost of the filter berms shall include the excavation, grading, stone for erosion control, rip-rap, etc., and all maintenance activities required.

The Contractor shall inspect the filter berm basins after each significant rainfall, and at regularly scheduled intervals, and repair or replace the filter berm basin if the Engineer determines unsatisfactory amounts of sediments are entering the culverts until the site has been stabilized.

The Engineer may direct the Contractor to erect and maintain gravel and rip-rap filter berm basins at other locations not shown on the Contract Drawings. Payment for this work shall be at the unit bid price for this item.

2.06 Stone Check Dams

Stone check dams shall be constructed as shown on the Contract Drawings and as specified herein. The stone check dams shall be constructed and maintained to the satisfaction of the Engineer until a vegetative ground cover has been established. Proper maintenance will include, but not be limited to, the periodic removal of trapped sediments. The cost of the stone check dams shall include the excavation, grading, stone for erosion control or rip rap, washed stone, etc., and all maintenance activities required.

The Engineer may direct the Contractor to erect and maintain stone check dams at other locations not shown on the Contract Drawings. Payment for this work shall be at the unit price bid for this item.

2.07 Stone Filters

Stone filters shall be constructed as shown on the Contract Drawings and as specified herein. The stone filters shall be constructed and maintained to the satisfaction of the Engineer until a vegetative ground cover has been established. Proper maintenance will include, but not be limited to, the periodic removal of trapped sediments. The cost of the stone filters shall include the excavation, grading, washed stone, filter fabric, steel post, etc., and all maintenance activities required.

The Engineer may direct the Contractor to erect and maintain stone filters at other locations not shown on the Contract Drawings. Payment for this work shall be at the unit price bid for this item.

2.08 Rip Rap

The Contractor shall place rip rap as shown on the Contract Drawings. The stone for rip rap shall consist of field stone or rough unhewn quarry stone. The stone shall be sound, tough, dense, and resistant to the action of air and water. The rip rap shall be Class I as specified in the NCDOT Standard Specifications. The stone shall vary in weight from 5 to 200 pounds. At least 30 percent of the total weight of the rip rap shall be in individual pieces weighing a minimum of 60 pounds each. Not more than 10 percent of the total weight of the rip rap shall be in individual pieces weighing less than 15 pounds each.

During placing, the stone shall be graded so that the smaller stones are uniformly distributed throughout the

mass. The Contractor may place the stone by mechanical methods, augmented by hand placing where necessary or ordered by the Engineer. The placed rip rap shall form a properly graded, dense, neat layer of stone. The placed rip rap shall have a minimum depth of 24-inches and shall have a layer of geotextile as specified in Section 2.03 placed between the soil and the stone.

The Engineer may direct the Contractor to place rip rap at other locations not shown on the Contract Drawings. Payment for this work shall be at the unit price bid for this item.

2.09 Stone for Erosion Control

The Contractor shall place Stone for Erosion Control as shown on the Contract Drawings, as specified herein and as specified in Section 1042-2 of the NCDOT Standard Specifications. The Stone for Erosion Control shall be Class (A) or Class (B), as shown on the Contract Drawings.

Stone for Erosion Control shall be dumped and placed in such a manner that the larger rock fragments are uniformly distributed throughout the rock mass and the smaller fragments fill the voids between the larger fragments. Rearranging of individual stones by equipment or by hand shall only be required to the extent necessary to secure the results specified above and to protect structures from damage when rock material is placed against the structures. The placed stone shall be the minimum thickness shown on the Contract Drawings and shall have a layer of geotextile as specified in Section 2.03 placed between the soil and the stone.

The Engineer may direct the Contractor to place Stone for Erosion Control at other locations not shown on the Contract Drawings. Payment for this work shall be at the unit price bid for this item.

2.10 Straw with Net Temporary Ditch Lining ^{OK}

The Contractor shall place straw ~~with~~ net temporary ditch lining in ditches as shown on the Contract Drawings. The blanket shall consist of clean wheat straw from agricultural crops made into a knitted straw blanket that is machine assembled. The straw shall be evenly distributed throughout the blanket. The blanket shall be covered with a photodegradable synthetic mesh attached to the straw with degradable thread.

The Contractor shall place the straw with net temporary liner where directed immediately after the ditch has been

properly graded and prepared, fertilized, and seeded. The netting shall be on top with the straw in contact with the soil. The blanket shall be unrolled in the ditch in the direction of the flow of water. The end of the upstream blanket shall overlap the buried end of the downstream blanket by a minimum of 4 inches. The blanket shall be stapled as per manufacturer's specifications.

The Contractor will immediately repair or replace any section of straw with net ditch lining which is not functioning properly or has been damaged in any way until a stable growth of grass has been established.

The Engineer may direct the Contractor to place straw with net ditch liner at other locations not shown on Contract Drawings. Payment for this work shall be at the unit bid price for this item.

2.11 Curled Wood Mat Temporary Ditch Lining

The Contractor shall place curled wood mat temporary ditch lining in ditches as shown on the Contract Drawings. The mat shall consist of machine-produced mat of curled wood excelsior with a majority of the fibers 6 inches or longer with consistent thickness and the fibers evenly distributed over the entire area of the blanket. The top of the mat shall be covered with a biodegradable synthetic mesh. The mesh shall be attached to the curled wood excelsior with photodegradable synthetic yarn.

The Contractor shall place the curled wood mat temporary liner where directed immediately after the ditch has been properly graded and prepared, fertilized, and seeded. The mesh shall be on top with the wood fibers in contact with the soil. The mat shall be unrolled in the ditch in the direction of the flow of water. The upstream end of each blanket shall be buried a minimum of 6". The downstream end of the upstream blanket shall overlap the buried upstream end of the downstream blanket by a minimum of 4 inches. The mat shall be stapled as per manufacturer's specifications.

The Contractor will immediately repair or replace any section of mat which is not functioning properly or has been damaged in any way until a stable growth of grass has been established.

The Engineer may direct the Contractor to place curled wood mat ditch liner at other locations not shown on Contract Drawings. Payment for this work shall be at the unit bid price for this item.

2.12 Synthetic Mat Permanent Ditch Lining

The Contractor shall place synthetic mat permanent ditch lining in ditches as shown on the Contract Drawings. The mat shall consist of entangled nylon, polypropylene or polyester monofilaments melt bonded at their intersections forming a three dimensional structure. The mat shall be crush-resistant, pliable, water-permeable, and highly resistant to chemical and environmental degradation.

The Contractor shall place the synthetic mat where directed immediately after the ditch has been properly graded and prepared. The mat shall be unrolled in the direction of the flow of water. The upstream end of each section shall be secured in an anchor trench at least twelve inches deep. The upstream end of mat shall overlap the downstream section by a minimum of three feet, with the upstream length on top. The mat shall be staked as per manufacturer's specifications.

After the mat has been placed, the area shall be properly fertilized and seeded as specified allowing the fertilizer and seeds to drop through the net.

The Contractor will immediately repair or replace any section of mat which is not functioning properly or has been damaged in any way until a stable growth of grass has been established.

The Engineer may direct the Contractor to place synthetic mat ditch liner at other locations not shown on Contract Drawings. Payment for this work shall be paid at the unit bid price for this item.

2.13 Water

Water will be furnished to the Contractor by the Owner from existing facilities as directed by the Engineer. The Contractor shall furnish all hoses and connections necessary to complete the landscaping work.

2.14 Fertilizer

Fertilizer shall be a complete commercial fertilizer with components derived from commercial sources. Fertilizer analysis shall be determined from field soil sampling in appropriate number taken by the Contractor and analyzed by the N.C. Department of Agriculture or other independent laboratory. Contractor shall furnish fertilizer in accordance with the recommendations of the Department of Agriculture.

One-quarter of the Nitrogen shall be in the form of nitrates, one-quarter in the form of ammonia salts, and one-half in the form of natural organic Nitrogen. Available Phosphoric Acid shall be free from superphosphate, bone, or tankage. Potash shall be Sulphate of Potash. Elements shall conform to the standards of Association of Official Agricultural Chemists.

Fertilizer shall be delivered in standard size bags marked with the weight, analysis of contents, and the name of the manufacturer. Fertilizer shall be stored in weatherproof storage areas and in such a manner that its effectiveness will not be impaired.

2.15 Lime

At least 50% shall pass a No. 200 U.S.S. mesh sieve. At least 90% shall pass a No. 100 U.S.S. mesh sieve and 100% shall pass a No. 10 U.S.S. mesh sieve. Total carbonates shall not be less than 80% or 44.8% Calcium Oxide equivalent. For the purpose of calculation, total carbonates shall be considered as Calcium Carbonate.

2.16 Grass Seed

The Contractor shall furnish the kinds and amounts of seed to be seeded in all areas disturbed by the construction work. All seed shall be labeled to show that it meets the requirements of the North Carolina Seed Law. All seed must have been tested within six (6) months immediately preceding the planting of such material on the job.

The inoculant for treating legume seed shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species. Inoculants shall not be used later than the date indicated on the container. The quality of the seed shall conform to the following:

<u>Type</u>	<u>Minimum Seed Purity (%)</u>	<u>Minimum Germination (%)</u>	<u>Maximum Weed Seed (%)</u>
Fescue (fungus free)	98	90	1.00
Hybrid Rye	98	85	0.10
Sudan grass	98	85	0.25
Millet	98	85	0.50
Sericea Lespedeza			

Scarified	98	85	0.50
Unscarified	98	85	0.50

Scarified Lespedeza may contain 20% hard seed and unscarified 50% hard seed. Seed containing prohibited noxious weed seed shall not be accepted. Seed shall be in conformance with N.C. Seed Law restrictions for restricted noxious weeds.

Seed mixtures to be used on the project shall be as follows:

- P - 150#/acre Kentucky 31 Tall Fescue
(Add 25#/acre Sudan grass in May. Add 25#/acre hybrid rye during Nov.)
- TW - 100#/acre Hybrid Rye
- TS - 35#/acre Pearl or Brown Top Millet; Sudan grass per roll, as manufactured by Amxco, American Excelsior Company, or equal.

Note: P - Permanent Seeding
 TW - Temporary Winter Seeding
 TS - Temporary Summer Seeding

On cut and fill slopes 2:1 or steeper add 30#/acre of Sericea Lespedeza to the P seed mixture. Sericea Lespedeza seed shall be scarified for spring plantings and unscarified for fall plantings.

2.17 Wood Cellulose Fiber Mulch

For use in hydroseeding grass seed in combination with fertilizers and other approved additions, shall consist of especially prepared wood cellulose fibers such as "Conwed", "Silva-Fiber", or equal, and have no growth or germination inhibiting factors.

The wood cellulose fiber shall have the additional characteristic of dispersing rapidly in water to form a homogeneous slurry and remain in such state when agitated in the hydraulic mulching unit, or adequate equal, with the specified materials.

When applied, the wood cellulose fiber with additives will form an absorptive mat but not a plant inhibiting membrane, which will allow moisture, natural or mechanical, to percolate into underlying soil.

The mulch shall be supplied, compressed in packages containing 50 pounds of material having an equilibrium air dry moisture content at time of manufacture of 12% plus or minus 2%. Wood cellulose fiber mulch shall be

stored in a weatherproof storage area and in such a manner that effectiveness will not be impaired.

2.18 Straw Mulch

Straw used for mulch shall be small grain hay. Hay shall be undamaged, air dry, threshed straw, free of undesirable weed seed. Straw mulch is not required for seeded areas treated with a temporary soil stabilizer.

2.19 Temporary Soil Stabilizer

The temporary agent for soil erosion control shall consist of an especially prepared highly concentrated powder which, when mixed with water, forms a thick liquid such as "TerraTack III", "Curasol AE", "Aerospray 70", or equal, and having no growth or germination inhibiting factors. The agent shall be used for hydroseeding grass seed in combination with other approved amendments resulting in a highly viscous slurry which, when sprayed directly on the soil, forms a gelatinous crust.

2.20 Other Work

In addition to the silt fences, temporary sediment basins, stone filters, etc., shown on the Contract Drawings, the Contractor shall provide adequate means to prevent any sediment from entering any storm drains (curb inlet filter box), 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 offsite 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 streets and driveways 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 specific payment will be made.

2.21 Temporary Ground Cover

Provide temporary or permanent ground cover adequate to restrain erosion on erodible slopes or other areas that will be left unworked for periods exceeding 30 calendar days.

PART 3 - EXECUTION

3.01 Establishment of Erosion Control Devices

Due to the nature of the work required by this Contract, it is anticipated that the location and nature of the erosion control devices will be adjusted on several occasions to reflect the current phase of construction. Erosion control devices shall be established prior to or concurrent with the clearing operations 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.

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. 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.

3.02 Maintenance of Erosion Control Devices

The Contractor shall furnish the labor, materials, and equipment required for routine 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. All erosion control devices shall be inspected immediately after each significant rainfall event, and appropriate maintenance conducted. Maintenance shall include but not be limited to 1) the removal and satisfactory disposal of trapped sediments from basins or silt barriers and 2) replacement of filter fabrics used for silt fences upon loss of specified efficiency. 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.

3.03 Grading

After approval of the rough grading, the Contractor shall commence his preparations of the subgrade for the various major conditions of the work as follows:

Bare soil for rip rap area at subgrade (24-inches below final grade, or as directed by the Engineer).

Final surface grading of the landscape graveled and rip rapped areas shall be mechanically raked or hand raked to an even finished surface alignment.

3.04 Hydroseeding and Grass

The Contractor shall grow a stand of grass by hydroseeding method on all disturbed areas. The Contractor shall be responsible for the satisfactory growth of grass throughout the period of the one-year guarantee.

The Contractor's work shall include the preparation of the bare soil seed bed, application of fertilizer, limestone, mulching, inoculant, temporary soil stabilizer, watering, and all other operations necessary to provide a satisfactory growth of sod at the end of the one-year maintenance period. Areas without satisfactory sod at the end of one (1) year shall be replanted until satisfactory growth is obtained and acceptable to the Engineer.

All areas to be seeded shall be done by the hydraulic seeding method including all additives and amendments required. A "Reinco", "Finn", or "Bowie" type hydromulcher with adjustable nozzles and extension hoses, or equal, shall be utilized. General capacity of tank should range from 500 to 2,500 gallons, or as approved by the Engineer.

Hydraulic seeding shall be carried out in three steps. Step one shall consist of the application of lime. In step two the seed mixture shall be mixed with the fertilizer, wood cellulose fiber mulch, and any required inoculants and applied to the seed bed. Step three shall consist of application of top dressing during the first spring or fall, whichever comes first, after step two.

Top dressing shall consist of a commercial grade fertilizer plus Nitrogen or other analysis as may be recommended by soil testing. Types and application rates of seed mixtures, lime, fertilizer, and wood cellulose fiber mulch, shall be as shown in the Seeding Schedule.

Ingredients for the mixture and steps should be dumped into a tank of water and thoroughly mixed to a homogeneous slurry and sprayed out under a minimum of 300-350 pounds pressure, in suitable proportions to accommodate the type and capacity of the hydraulic machine to be used. Applications shall be evenly sprayed over the ground surface. The Contractor shall free the soil of stones, roots, rubbish, and other deleterious materials and dispose of same off the site. The bare soil, except existing steep embankment area, shall be

rough raked to remove stones, roots, and rubbish over 4-inches in size, and other deleterious materials and dispose of same off the site.

No seeding should be undertaken in windy or unfavorable weather, when the ground is too wet to rake easily, when it is in a frozen condition, or too dry. Any bare spots shown in two to three weeks shall be recultivated, fertilized at half the rate, raked, seeded, and mulched again by mechanical or hand broadcast method acceptable to the Engineer.

Areas that have been seeded with a temporary seed mixture shall be mowed to a height of less than 2-inches and scarified prior to seeding with the permanent seed mixture.

The Contractor shall provide, at his own expense, protection for all seeded areas against trespassing and damage at all times until acceptance of the work. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly at the Contractor's expense.

The Contractor shall water newly seeded areas of the lawn and road shoulder mix once a week until the grasses have germinated sufficiently to produce a healthy turf, or unless otherwise directed by the Engineer. Each watering shall provide three (3) gallons per square yard. The Contractor shall furnish all necessary hoses, sprinklers, and connections.

The first and second cutting of the lawn grasses only shall be done by the Contractor. All subsequent cuttings will be done by the Owner's forces in a manner specified by the Contractor.

3.05 Maintenance

The Contractor shall be responsible for maintaining all seeded areas through the end of his warranty period. Maintenance shall include but not be limited to, annual fertilization, mowing, repair of seeded areas, irrigation, and weed control. The Contractor shall provide, at his own expense, protection for all seeded areas against trespassing and damage at all times until acceptance of the work. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly at the Contractor's expense.

Annual fertilization shall consist of an application of 500#/acre of 10-10-10 commercial grade fertilizer, or its equivalent and 60#/acre of nitrogen in early fall, or other analysis as may be determined by soil test. Annual

fertilization shall be in addition to top dressing and shall be performed by the Contractor each fall season after planting until the work is substantially complete.

Mowing shall be scheduled so as to maintain a minimum stand height of 4-inches or as directed by the Engineer. Stand height shall be allowed to reach 8 to 10-inches prior to mowing.

All seeded areas shall be inspected on a regular basis and any necessary repairs or reseeding made within the planting season, if possible. If the stand should be over 60% damaged, it shall be re-established following the original seeding recommendations.

Weed growth shall be maintained mechanically. No herbicide shall be used.

3.06 Cleanup

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.

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.

3.07 Seeding Schedule

All seeding and mulching to be completed by the Contractor shall conform to the schedule as shown on the Contract Drawings. No permanent seeding shall be performed from June 1 - August 31 and December 1 - January 31. Temporary seed mixtures will be used during these times if seeding is necessary. Areas seeded with temporary seed mixtures shall be reseeded by the Contractor at no additional cost to the Owner with permanent seed as directed by the Engineer.

Application rates of seed mixtures, lime, fertilizer, mulch and top dressing are shown in the schedule on the Contract Drawings.

PART 4 - MEASUREMENT AND PAYMENT

4.01 Payment

All work described in this section and required for completion of the work shall be included for payment in the Contractor Lump Sum Price, Pay Item No. 1.

- A. Silt Fence placed in addition to the locations indicated on the Contract Drawings and approved in the Engineer shall be paid on the basis of the Unit Price Bid for Furnishing Additional Silt Fence, Pay Item 7, per linear foot in-place.
- B. Temporary Sediment Basins constructed in addition to those shown on the Contract Drawings shall be paid for on the basis of the Unit Price Bid for Furnishing Additional Temporary Sediment Basins, Pay Item No. 8, per basin completed in accordance with the appropriate details shown on the Contract Drawings.

* * * *

SECTION 2H
UTILITY STRUCTURES

PART 1 - GENERAL

1.01 Work Included

Furnish and install all equipment and materials in connection with the construction of utility structures and appurtenances, complete with frames, covers, gratings, etc.; connecting existing lines to new structures and adjustment of existing structures to new grades, modifications to existing structures to new grades, all as shown on the Contract Drawings and as specified herein.

Prefabricated HDPE sumps and manholes are included in this section.

1.02 Related Work

Excavation and backfill are specified under Section 2C, Earthwork. Concrete is specified under Division 3.

1.03 Testing

Testing of structures for watertightness shall be as specified in Part 4 of this Section.

1.04 Submittals

In accordance with the procedures and requirements set forth in the General Conditions and Division 1, the Contractor shall submit the following:

1. Shop Drawings
2. Material certificates on all piping, sump and manhole materials

Each submittal shall be identified by the Specification Section Number.

PART 2 - MATERIALS

2.01 General Information

All materials specified shall be produced in a plant of recognized reputation and regularly engaged in the

production of materials conforming to the specified standards. All materials shall be new and both workmanship and materials shall be of the very best quality, entirely suitable for the service to which the units are to be subjected. All material of the same kind supplied for the work shall be produced by the same manufacturer.

2.02 Prefabricated HDPE Sumps

Prefabricated HDPE sumps shall be constructed of components manufactured from high performance, high molecular weight, high density, virgin polyethylene by an approved Polyethylene Fabricator as detailed in the Contract Drawings. HDPE pipe used shall be of sufficient SDR to maintain a minimum nominal thickness of 1 inch. HDPE sheet shall have a minimum thickness of 1 inch.

All Prefabricated HDPE sumps shall be tested for water tightness by filling with clean water and checking for weld leaks prior to installation. Any and all leaks shall be repaired using extrusion welds.

PART 3 - EXECUTION

3.01 General

No concrete shall be placed until the depth, character of the foundation and the placing of the steel have been inspected and approved by the Engineer.

3.02 Installation

A. General

It is the intent of this Specification to secure soundly constructed, watertight structures built in accordance with the details shown on the Contract Drawings. Under no condition shall foundations be placed upon frozen or muddy subgrades.

Where existing pipes containing liquids are to be connected to structures the work shall be kept in the dry until completed by utilizing plugs, bypasses or pumping. The method is subject to the approval of the Engineer.

B. Concrete Ballast for Manholes

Concrete ballast shall be provided for the manholes indicated on the Contract Drawings. Class B concrete as specified in Section 3A shall be used for concrete ballast. Ballast shall be placed against the outer wall of the manhole around the entire periphery for the full height of the ballast. Ballast shall bear directly on the extended manhole base and shall extend no more than 24-inches beyond the edge of the manhole wall. Ballast shall be placed in such a manner that a monolithic ring (collar) is formed around the manhole.

Additional ballast concrete over that indicated may be required according to the final grade and depth of manholes. Additional ballast concrete shall be provided as directed by the Engineer.

C. Existing Pipelines

The Contractor shall verify the diameter and invert elevation of all existing pipelines to be connected to new structures prior to starting work on such new structures. Existing pipelines connecting to new structures shall be neatly built into the structure to provide a leak-tight connection. Before depositing concrete against existing pipes, the pipe surfaces shall be thoroughly cleaned of all foreign matter and shall be coated with an epoxy adhesive in accordance with the manufacturer's instructions. The Contractor shall cut-off and remove completely a sufficient amount of the existing pipe, required to make the connection to the new structure. The Contractor shall grout both the inside and outside of the wall penetration with non-shrink grout. A rubber ring waterstop of the correct size shall be used to insure a watertight fit around the entire periphery of the pipe. The flexible joint sealer (donut) shall be as manufactured by Fernco Joint Sealer Co., or equal.

The Contractor shall provide adequate protection to prevent any damage to the existing piping.

The Contractor shall provide adequate means for plugging and/or transferring the existing flow in the pipe to allow for the construction of inverts and wall penetration grouting.

D. Adjustments of Existing Structures

When adjustment of existing structures to new grades is required, the frames and covers or inlets shall be adjusted by approved methods using concrete or by using cast iron adjustment rings.

E. Existing Cover and Inlet Castings

All existing covers and inlet castings shall be removed, thoroughly cleaned of all foreign matter and painted with one coat of coal tar epoxy.

F. Adjusting Collars and Final Adjustments

Adjusting collars shall be as shown on the Contract Drawings. Final adjustments shall be made so that the manhole ring and cover will be smooth and flush with the finished grade of the adjacent surface, or as otherwise indicated on the Contract Drawings for manholes shown above grade.

G. Prefabricated HDPE Sumps

The prefabricated HDPE sumps shall be installed at the locations and to the elevations as shown on the Contract Drawings. Calculations made by the Contractor necessary to locate the sumps and associated items shall be furnished to the Engineer for review prior to field location of the items. The Contractor shall also give the Engineer sufficient notice so he may observe the field location and installation activities.

The prefabricated HDPE sumps shall be set in a Cement/Bentonite grout as detailed on the Contract Drawings. Prior to setting the sumps in the grout, the sumps shall be kept at the proper elevation by using bricks located around the outermost edge of the base of the sump. All pipe connections shall be made to the sump after it has been set at the proper elevation and prior to setting it in the cement/bentonite grout.

After all connections have been made the cement/bentonite grout shall be tremied under and around the sump such that no voids are present in the grout. The grout shall be placed to the approximate limits as indicated on the Contract Drawings. No other construction activity shall take place in the immediate vicinity of the sump until the cement/bentonite grout has cured sufficiently to prevent movement of the sump.

H. Prefabricated HDPE Manholes

The prefabricated HDPE manholes shall be installed at the locations and to the elevations indicated on the Contract Drawings. Calculations made by the Contractor necessary to locate the manholes and associated items shall be furnished to the Engineer for review prior to field location of the items. The

contractor shall also give the Engineer sufficient notice so he may observe the field location and installation activities.

The manholes will be bedded and backfilled as indicated on the Contract Drawings.

3.03 Backfilling

Backfilling at structures shall be in accordance with Section 2C, Earthwork and as shown on the Contract Drawings.

3.04 Cleaning

All structures, existing and new, shall be cleaned of any accumulation of silt, debris or foreign matter of any kind and shall be kept clear of such accumulation until final acceptance of the work.

PART 4 - FLUSHING AND TESTING

4.01 Flushing and Testing

- A. Obstruction - After backfilling, all collector or header pipes shall be inspected for obstructions and shall be flushed with water. Flushing shall be a minimum velocity of 2.5 feet per second for a duration acceptable to the Engineer. Flushing shall remove all dirt, stones, pieces of wood and other debris which accumulated in the pipe during construction. The Contractor shall provide a means acceptable to the Engineer for removal of debris flushed from each section of sewer. If after flushing, any obstructions remain, they shall be removed at the Contractor's expense.
- B. Visual Inspection - Header pipes shall be visually inspected from every manhole by use of mirrors, television cameras, or other devices for visual inspection, and the lines shall all exhibit a fully circular pattern when viewed from one manhole to the next. Lines which do not exhibit a true line and grade or have structural defects shall be corrected to meet these qualifications.
- C. Leakage - Header pipes shall be tested for leakage. The program of testing shall fit the conditions as mutually determined by the Engineer and the Contractor. The Contractor shall take all necessary precautions to prevent any joints from drawing while

the headers or their appurtenances are being tested. The Contractor shall, at his own expense, correct any excess leakage and repair any damage to the pipe and their appurtenances, or to any structures resulting from or caused by these tests.

- D. Leakage Test Procedure - Each section of header shall be tested by closing the lower end of the header to be tested and the inlet sewer of the upper manhole or sump with stoppers and filling the pipe and manhole or sump with water to a point 6 feet above the crown of the open pipe in the upper manhole, or, if ground water is present, 6 feet above the sections average adjacent ground water level as indicated by a monitor well installed adjacent to each manhole. The line shall be filled with water prior to testing and allowed to stand until the pipe has reached its maximum absorption, but not less than two (2) hours. After maximum absorption has been reached, the head shall be re-established and tested for at least six (6) hours maintaining the head specified above by measured additions of water. The sum of these additions shall be the leakage for the test period.

No leakage from the header pipes, manhole or sump shall be acceptable.

Where the actual leakage exceeds the allowable, the Contractor shall discover the cause and correct it before the header will be accepted. For the purpose of this subsection, a section of header is defined as that length of header between successive manholes, special structures or stubouts for future connections.

- E. Low Pressure Compressed Air Test - If the leakage cannot be located by infiltration or exfiltration testing, this type test may be used. The pipeline shall be considered acceptable, when tested at an average pressure of 10 psi with no loss of pressure over 15 minutes.
- F. Deflection Test - No sooner than thirty (30) days after final backfill installation, each section of header pipe shall be checked for vertical deflection using an electronic deflecto-meter or a rigid "Go-No-Go" device. Vertical deflection shall not exceed five (5) percent of the inside pipe diameter for the header pipe.

Where the actual deflection exceeds the allowable, the Contractor shall discover the cause and correct it before the pipe will be acceptable. For the purpose of this subsection, a section of header is defined as that length of header pipe between successive

manholes, sumps, or special structures or stubouts for future connections.

- G. Cost of Testing and Repairs - Any and all work necessary to bring the line into conformance with the infiltration and deflection specifications shall be performed by the Contractor at no extra cost to the Owner. All apparent sources of infiltration and excessive deflection shall be repaired by the Contractor.

The Contractor shall provide all water, plugs, hoses, pumps, equipment, etc. necessary for the proper flushing and testing of the sewers.

PART 4 - MEASUREMENT AND PAYMENT

4.01 Payment

- A. All work described in this section and required for completion of the work shall be included for payment in the Contractor Lump Sum Price, Pay Item No. 1.

* * * *

SECTION 13250

POLYPROPYLENE GEOMEMBRANE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish all labor, material and equipment to install geomembrane including all necessary and incidental items as detailed or required to complete the installation in accordance with the Contract Drawings and these Specifications. The Contractor shall be responsible for timely submittals to the Engineer.
- B. The anchor trench shall be excavated, maintained and backfilled by the Contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Earthwork
- B. Geotextile
- C. Geonet

1.03 SUBMITTALS

- A. The material for the geomembrane shall be an approved polypropylene (PPE) geomembrane in strict accordance with the Contract Drawings and these Contract Specifications. The geomembrane and Geomembrane Manufacturer shall be approved by the Engineer and the Owner prior to Contract award.
- B. All compound ingredients (raw material) for PPE geomembrane shall be randomly sampled and tested by the Geomembrane Manufacturer. A test result summary shall be furnished to the Engineer to assure compliance with the material requirements of this specification item. The sampling frequency and testing procedures shall comply with the requirements as outlined in Table 1, Section 13250 of these Specifications. A copy of the testing program, including frequency of tests per quantity of raw material and test method procedures, shall be submitted to the Engineer with the Contractor bid as part of the Geomembrane Manufacturer's QC Manual. The summary of test results reflecting actual test frequency shall be furnished to the Engineer prior to or coincident with shipment of the geomembrane to the project site.
- C. The certified summary of all raw material and geomembrane material tests, including testing frequency and test methods used, shall be issued to the Engineer prior to geomembrane delivery. No geomembrane shall be installed until the Engineer has reviewed the certified test summary and determined the geomembrane delivered is acceptable for use. Records, including test data, shall be maintained by the Geomembrane Manufacturer for one year and shall be made available upon request.

- D. The Contractor shall submit to the Engineer Quality Control Certificates reviewed and signed by the responsible representative of the Geomembrane Manufacturer. A Quality Control Certificate shall be submitted for each roll of geomembrane delivered to the project site prior to installation. Any roll not represented by a completed Quality Control Certificate shall not be approved for installation by the Engineer.

PART 2 -- MATERIAL REQUIREMENTS AND CONFORMANCE TESTING

2.01 PPE GEOMEMBRANE MATERIAL REQUIREMENTS

- A. Material for the geomembrane shall include pure polypropylene, carbon black, and a maximum of 1 percent of other additives by weight. The geomembrane shall be manufactured of new, first quality products designed, manufactured and furnished by means consistent with National Sanitation Foundation (NSF) Standards. The geomembrane manufacturer shall have demonstrated, by successful prior use, that said material is suitable and dependable for such purposes.

The geomembrane shall be produced so as to be free of holes, blisters, undispersed raw materials or any sign of contamination by foreign matter. Any such defect shall be repaired as approved by the Engineer. The Engineer may reject all or portions of units (or rolls) of geomembrane if significant quantities of production flaws are observed. The physical properties of the geomembrane shall be as described on Table 1, Section 13250 of these Specifications.

- B. Thickness of the finished geomembrane shall be -10% to +10% of the nominal thickness value specified.
- C. The outside of each roll shall identify product designation, the thickness of the sheet, panel number, if applicable, the length and width of each roll and manufacturer's batch or lot number. Roll identification numbers shall conform to the numbering system established on the Quality Control Certificates submitted by the Geomembrane Manufacturer.

Labels or marking shall be located so that each roll of geomembrane can be identified by examining the roll or core edges. Markings or labels shall be weather proof.

- D. During production, the geomembrane manufacturer shall sample and test the manufactured sheet in accordance with applicable ASTM Standards. The minimum sampling frequency, testing procedures, and sheet physical properties, shall comply with the requirements as outlined in Table 1, Section 13250 of these Specifications.
- E. At the option of the Owner, the Engineer may inspect the geomembrane manufacturing process on a full-time basis. The inspection program includes conformance sampling as required. The Geomembrane Manufacturer shall submit a production schedule to the Owner if requested and cooperate with the Owner during plant inspection.

2.02 QUALITY ASSURANCE CONFORMANCE TESTING

- A. Quality assurance conformance testing of the geomembrane shall be performed by the Engineer and paid for by the Owner. Conformance sampling shall be completed at a minimum frequency of one sample every 200,000 square feet of geomembrane delivered and

at least one sample per lot or batch as directed by the Engineer. The Owner has the option to increase the frequency of conformance testing or to sample and test any questionable roll or lot.

Conformance testing of the geomembrane shall include but not be limited to the following properties:

1. Specific Gravity, ASTM D792
2. Carbon Black Content, ASTM D1603
3. Thickness, ASTM D751
4. Tensile Properties, ASTM D638
5. Tear Resistance, ASTM D1004
6. Puncture Resistance, ASTM D4833

The Engineer may revise the test methods used for determination of conformance properties to allow for use of improved methods.

- B. All geomembrane conformance test data as well as Geomembrane Manufacturer Quality Control testing shall meet or exceed requirements outlined in Table 1, Section 13250 of these Specifications prior to installation. Any materials that do not conform to these requirements shall be retested or rejected at the direction of the Engineer.

Geomembrane that is rejected shall be removed from the project site and replaced at Contractor's cost. Sampling and conformance testing of geomembrane supplied as replacement for rejected material shall be performed by the Engineer at the Contractor's cost.

PART 3 -- EXECUTION

3.01 INSTALLER QUALIFICATIONS AND SUBMITTALS

- A. The Contractor shall be responsible for timely submittals to the Engineer and the Owner.
- B. The Geomembrane Installer must be approved by the Engineer and the Owner prior to Contract award. Geomembrane Installer qualifications shall be submitted for approval with the Contractor's bid, certifying that the Geomembrane Installer has installed a minimum of one million square feet of PPE geomembrane for hydraulic containment purposes.
- C. Approximately two weeks prior to arrival at the job site, the Geomembrane Installer shall provide personnel resumes demonstrating compliance with the following requirements:
1. A minimum of one field superintendent per shift shall be designated by the Geomembrane Installer and approved by the Engineer and the Owner. Each field superintendent shall have a minimum of one year of field experience in installing PPE geomembranes. Any change or replacement of superintendents during the project must be approved in advance by the Engineer and the Owner.

2. Each seaming crew shall have a designated foreman. Said foreman must have a minimum one year PPE geomembrane installation experience and must work continuously with the seaming crew.

D. The Geomembrane Installer shall submit for the Engineer's approval, approximately two weeks prior to geomembrane shipment, six full sets of field erection drawings showing geomembrane panel layout with proposed length and width, number and position of all geomembrane panels and indicating the location of all field seams. Erection drawings shall also show complete details for field seaming and repairs, anchoring the geomembrane at the perimeter of the installation area, joining to structures, and attachments to other penetrations as required.

3.02 PRECONSTRUCTION MEETING

A. Prior to scheduled geomembrane installation, the Engineer, Contractor, and Geomembrane Installer shall be required to attend a pre-construction meeting at the project site. This meeting shall be scheduled by the Owner after receipt of field erection drawings.

The Geomembrane Installer shall be represented by both the project field superintendent and the project manager.

At the pre-construction meeting, site safety and rules of operation, quality assurance, scheduling and methods of installation shall be discussed. The Geomembrane Installer and Engineer shall at this time agree to the required seaming, testing and repair procedures.

3.03 GEOMEMBRANE STORAGE AND HANDLING

A. Extreme care shall be taken by personnel while handling, unwrapping, transporting, positioning, and seaming the geomembrane. The Engineer shall have the option of inspecting all geomembrane panels, prior to final placement, to assure that all defects or damages are identified for repair. This shall not replace final inspection by the Geomembrane Installer after installation is complete. Damage to geomembrane incurred during delivery, storage, or installation shall be repaired or replaced at no expense to the Owner.

Geomembrane shall be stored in a suitable area designated by the Owner. Geomembrane delivered on pallets or with folds or creases of any kind shall be rejected and removed from the site.

Geomembrane shall be protected during storage so that roll labels remain in-tact and readable. Any roll of geomembrane that has no label or where the label is damaged or otherwise illegible may be rejected by the Engineer.

3.04 GEOMEMBRANE PREPARATION AND PLACEMENT

A. A daily field record shall be maintained by the Geomembrane Installer of actual placement of each panel, noting the condition of subgrade, weather, seaming parameters, panel numbers placed, seams welded, samples taken and tests run. A copy of each day's field record shall be submitted to the Engineer or his representative no later than the following work day.

- B. The surfaces that are to receive the geomembrane shall be prepared in accordance with the Contract Drawings and these Contract Specifications. Once the subgrade has been approved by the Engineer, any additional surface preparation that the Contractor or Geomembrane Installer feels necessary to meet the requirements of the Contract Specifications, shall be the responsibility of the Contractor. The Geomembrane Installer shall install geomembrane only on approved subgrade that has been approved in writing by the Geomembrane Installer, Contractor, and the Engineer.

The geomembrane shall be placed only on subgrade that is free from rutting or other evidence of damage caused by vehicle traffic, erosion or other causes. Subgrade surface requirements, including allowances for desiccation cracking, shall be as outlined in Section 2C, Earthwork, in these Contract Specifications.

Areas exhibiting deficient subgrade surface shall be reported to the Engineer and the Owner for repair.

- C. It is imperative to keep surface water runoff from beneath the geomembrane at all times during installation. The Geomembrane Installer's panel placement, seaming technique, placement and seaming schedule shall minimize or eliminate the potential for accumulation of water beneath the geomembrane. Any water found ponded beneath the geomembrane after the geomembrane has been installed shall be removed by the Contractor as directed by the Engineer at no cost to the Owner. Any soil subgrade beneath installed geomembrane that has become excessively moist, soft, or unsuitable to perform its intended function shall be removed and replaced by the Contractor as directed by the Engineer, at no expense to the Owner.
- D. Under no circumstances shall any construction or vehicular traffic be allowed to drive over the exposed geomembrane. Geomembrane showing evidence of traffic shall be inspected by the Geomembrane Installer, Contractor and Engineer to determine damage, if any. At the direction of the Engineer, any such material shall be tested, rejected or repaired at no cost to the Owner.
- E. The Geomembrane Installer shall provide temporary anchorage of the geomembrane during installation in a manner approved by the Engineer. Any geomembrane exhibiting damage from wind or other causes shall be removed and replaced at no cost to the Owner.
- F. The Contractor shall be responsible for excavation and maintenance of the geomembrane anchor trench as well as backfilling of the anchor trench.

The anchor trench shall be "daylighted" to allow drainage while the trench is open. The Contractor shall be responsible for preventing surface water runoff from accumulating beneath or over top of geomembrane while the anchor trench is open.

- G. The geomembrane shall be installed so as to eliminate "trampolining" of the geomembrane at the toe of slopes at temperatures as low as 0°F. If trampolining is observed, the Engineer shall direct required repair in affected areas to be performed by the Geomembrane Installer at no expense to the Owner.

In critical areas such as sidewalls, sumps, and corners, the Contractor may propose slack control techniques for approval by the Engineer.

- H. Seams shall be oriented in a direction parallel to the line of maximum subgrade slope and shall be placed in a manner that minimizes the number and length of field seams.

For geomembranes placed on slopes, the panels shall be placed such that the "upstream" panel forms the upper panel and overlaps the "downstream" panel in order to minimize infiltration potential.

- I. All longitudinal seams shall be at least 10 ft. from the toe of the sideslope, except in the sump area as directed by the Engineer. No longitudinal seams shall be completed on side slopes.

3.05 TRIAL SEAMS

- A. The Geomembrane Installer shall be responsible for performing field testing of all trial seams. The Geomembrane Installer shall submit for Engineer's review and approval at the time of bid submittal, a trial seam quality control testing program. The Geomembrane Installer shall modify the quality control testing program to comply with the Engineer's requirements for testing, sampling and resampling of trial seams as outlined in these Contract Specifications.
- B. Trial seams shall be performed for each seaming device whenever any of the following conditions occur: (1) shift start-up, (2) "cold" restart of the device, (3) change in technician, (4) significant change in ambient temperatures, or (5) as required by the Engineer.

Trial seams shall at least 10-ft in length and be conducted using the same personnel, equipment and seaming parameters as will be used during production seaming.

Sampling of the trial seam shall be conducted from the center two-thirds of the seam length once an appropriate cooling period has passed.

- C. The Geomembrane Installer shall obtain duplicate "preweld" test samples, suitable for testing. One sample shall be kept by the Geomembrane Installer for testing at the project site in the presence of the Engineer. The duplicate sample shall be furnished to the Engineer for the project record and/or possible future testing. The duplicate sample shall be marked with date, time, ambient temperature, welder, and seaming parameters (temperature, rate of travel, etc.). Specimens tested by the Geomembrane Installer shall be marked and stored on the project site for inspection by the Owner or the Engineer.
- D. Test results acceptable to the Engineer shall be obtained prior to performing any installation production seaming. This may require resampling completed test seams or repeating the trial seam process. The results of tests shall be noted in the Geomembrane Installer's "preweld" test summary log or daily diary and a copy furnished to the Engineer not later than the next work day.
- E. The trial seam test specimens shall be tested in peel in accordance with the approved quality control testing program. A minimum of three specimens shall be tested for each trial seam. Qualification criteria for all destructive prewelding testing shall be the Film Tear Bond (FTB) criteria. The failure of the seam specimen shall be in the parent sheet, not the weld. Under certain conditions, a partial disbond observed during peel testing of 10% of the weld width or less, may be accepted by the Engineer. Testing of additional specimens shall be performed as required by the Engineer. A failure within the weld area as designated by the

Engineer shall constitute disqualification and require a new trial seam test of the seaming equipment, as directed by the Engineer.

- F. For double hot wedge type seams, both seams shall be tested for all field and laboratory destructive testing.

3.06 PRODUCTION SEAMING

- A. All seaming, sealing and welding equipment and materials shall be of a type or types recommended by the Geomembrane Manufacturer.
- B. No production seaming shall commence until trial seaming, as outlined in Section 3.05 of these Specifications, is successfully completed and approved by the Engineer.
- C. The Engineer and the Owner, in conjunction with the Geomembrane Installer and Contractor, shall establish site-specific limits of weather conditions, including, but not limited to, temperature, humidity, precipitation and wind speed and direction, within which geomembrane panel placement and seaming can be conducted. In the absence of site-specific criteria, the following limitations shall apply:
 - 1. No seaming shall be conducted in the presence of precipitation, such as rain, snow, sleet, dew or fog, in or below the seam area.
 - 2. No seaming shall be conducted in the presence of high winds, when dirt or debris is blown into seam areas, or when seam temperatures cannot be adequately monitored and controlled.
 - 3. Seaming shall not be conducted when ambient temperature falls below 35°F unless approved by the Engineer. In order for seaming to be approved, the Geomembrane Installer shall be required, at a minimum, to perform an additional trial seam to demonstrate conformance with these Specifications. The Engineer reserves the right to require additional destructive seam testing when seaming is conducted at ambient temperatures below 35°F.

The Geomembrane Installer shall be prepared to pre-heat the seam area prior to production seaming in accordance with the Geomembrane Manufacturer recommendations.
 - 4. Seaming shall not be conducted when ambient temperature exceeds 104°F unless approved by the Engineer. Criteria for demonstration of conformance shall be outlined by the Engineer.
- D. Lap joints shall be used to join panels of geomembrane together in the field. A minimum overlap of 3-inches shall be used. Seams shall be hot air or hot wedge fusion as prescribed by the Geomembrane Manufacturer and approved by the Engineer. For production seaming of geomembrane panels, double hot wedge fusion seaming is the preferred method. Panels shall be held in position in a manner approved by the Engineer, to prevent movement during welding, and to maintain a "flat" lap of panels. The seam area shall be prepared to provide a suitable surface for adherence to panels to be seamed. The seam area shall be free of dirt, dust, moisture, or other foreign material. The seam shall be applied as soon as is practical after preparation and cleaning is completed. No glue or tape shall be used to temporarily hold panels together before seaming. No solvents shall be used to clean panels prior to seaming.
- E. All Geomembrane panels placed shall be permanently seamed on the same day that they are placed except where explicitly approved by the Engineer.

- F. No folds, wrinkles, or "fish-mouths" shall be allowed within the seam area. Where wrinkles or folds occur, the material shall be cut, overlapped, and a patch shall be applied. During wrinkle or fold repairs, adjacent geomembrane may not necessarily be required to meet the 3-inch minimum overlap, if approved by the Engineer.
- G. The Geomembrane Installer shall not cause excessive overheating of the geomembrane. Excessive overheating shall be defined as any of the following:
 - 1. Application of seaming temperatures or seaming rates that result in visible warping or deformation of the bottom surface of the lower geomembrane in the seam area.
 - 2. Seaming over an existing weld ("piggybacking").
 - 3. Seaming using temperatures in excess of the manufacturer's recommended seaming temperature as defined at the pre-construction meeting.
- H. Repairs
 - 1. Surface defects, small tears, punctures, etc., shall be repaired using a patch with a minimum size of 12 inches by 12 inches.
 - 2. Under no circumstances shall seams be placed over existing seams for repair.
 - 3. Fusion seams shall be repaired by using a patch or cap strip approved by the Engineer.
 - 4. "T-seams" shall be covered with a minimum 12 inch by 12 inch patch.
- I. The Engineer may require repair or replacement of any area where overheating, or unacceptable preparation, seaming or testing techniques are observed. Such repair or replacement may be required even if samples removed from affected areas pass destructive peel or shear testing.

All required repairs shall be completed by the Geomembrane Installer at no expense to the Owner.

3.07 PRODUCTION SEAM TESTING

- A. The Geomembrane Installer shall be responsible for completing nondestructive testing of the entire length (100%) of all field seams, including patches and cap strips, and verifying that all seams are watertight. The testing method shall be a vacuum test, air-pressure test, or approved equal. The test procedure shall be described in writing by the Geomembrane Installer and submitted with the bid and approved by the Engineer prior to installation. Upon completion of the vacuum testing, air-pressure test, or approved equal, a written report shall be submitted to the Engineer by the Geomembrane Installer certifying that all seams were tested.

Seams or portions of seams that cannot be nondestructively tested due to access constraints or other reasons may be required to be covered with a cap-strip as required by the Engineer.

B. The Engineer shall approve procedures proposed by the Geomembrane Installer for nondestructive testing of geomembrane seams including, but not limited to, the following items:

1. Vacuum Test (as required)
 - 1.1 Test device
 - 1.2 Vacuum pressure
 - 1.3 Vacuum duration at each location
2. Air Pressure Testing (as required)
 - 2.1 Maximum pressure
 - 2.2 Test duration
 - 2.3 Maximum allowable pressure drop
 - 2.4 Allowance for geomembrane expansion or contraction during pressure testing
 - 2.5 Retesting procedures

C. Where practical, the Geomembrane Installer or Engineer shall sample the ends of production seams at the panel ends. Field destructive testing for these samples shall be performed on-site by the Geomembrane Installer using the test method and approval criteria outlined in Section 3.05 for trial seams samples.

If the end samples do not exhibit acceptable failures, the Engineer may require that the Geomembrane Installer sample additional locations on the same seam and/or adjacent seams for laboratory destructive testing.

D. The Geomembrane Installer shall obtain duplicate samples of production seams suitable for destructive testing. The samples shall be obtained at a minimum rate of one pair (sample and duplicate) per 1,000 linear feet of seam. Additional samples shall be removed by the Geomembrane Installer from areas of questionable integrity, as directed by the Engineer. The Engineer shall be responsible for destructive testing one of the sample pairs. The duplicate sample shall be furnished to the Engineer for the project record and/or possible future testing. These samples shall be obtained from locations as directed by the Engineer and shall be repaired by the addition of a patch to the sampling location. Each sample size shall not be less than 12 inches by 24 inches with the longer dimension measured parallel to the seam. The seam shall be in the center of the sample parallel to the longer dimension of the sample. The seam repair at destructive test sample location shall be nondestructively tested by the Geomembrane Installer to verify its integrity.

An additional sample may be retained for testing by the Geomembrane Installer. This testing, if performed, shall be completed at no cost to the Owner.

E. The seam in the destructive sample shall be laboratory tested in peel (ASTM D413) and shear (ASTM D3083). Qualification criteria for all destructive seam testing shall be the Film Tear Bond (FTB). The failure of the seam specimen shall be in the parent sheet, not the seam itself. Under certain conditions, a partial disbond observed during peel testing of 10% of the weld width or less, may be accepted by the Engineer. A failure within the seam area as designated by the Engineer shall require resampling and retesting, as directed by the Engineer.

At least five specimens from each laboratory destructive test sample shall be tested for Peel Adhesion using ASTM D413 using a minimum of 1-inch wide by 6-inch long die cut specimens and a strain rate of 2-inches per minute. The load at failure shall be 60 percent of the breaking strength of the parent geomembrane (in pounds per inch width) or greater.

A minimum of five specimens from each laboratory destructive test sample shall be tested for Bonded Seam Strength using ASTM D3083 using 1-inch wide by 6-inch long die cut specimens and a strain rate of 2-inches per minute. The load at failure shall be at least 80 percent of the breaking strength (in pounds per inch width) of the parent geomembrane.

- F. In order for the destructive sample to be considered qualified, at least four of the five peel and four of the five shear specimens shall meet all load and FTB criteria. If any specimens fail, the Engineer may test additional specimens from the sample in order to determine seam conformance. The Engineer shall determine conformance of each sample in cases of dispute.
- G. Destructive laboratory conformance testing shall be the responsibility of the Engineer, and associated costs shall be performed at Owner expense. The Geomembrane Installer shall be responsible for all sampling and repair of sample locations for laboratory and field destructive testing.
- H. Should the test results of any destructive test samples removed from production seams not meet the conformance criteria outlined in these Specifications, the Engineer may require that additional samples be taken from seams performed during the same work shift as the failing seam sample. If a destructive sample fails to meet the physical properties required by the Specifications, the Geomembrane Installer shall obtain additional test samples a distance of approximately 10-feet in both directions from the original sample for laboratory destructive testing. All resampling, repairing, and retesting shall be the responsibility of the Geomembrane Installer and shall be performed at the Geomembrane Installer's expense. Depending on the results of these retests, the Engineer shall approve the repair procedure.

In order to be considered qualified, each failed destructive seam sample shall be bounded by two passing destructive seam samples. Alternatively, the entire length of the seam in question may be repaired by placement of a cap strip.

- I. The Engineer or the Owner may require additional random samples be taken for destructive testing in areas that visually appear defective and/or not in accordance with these Specifications. Testing of these samples shall be completed by the Engineer, but obtaining the samples and repairing the sample areas shall be the responsibility of the Geomembrane Installer.
- J. A final visual examination of all seams and in-place geomembrane shall be completed by the Engineer. The Geomembrane Installer shall repair, in accordance with these Specifications, any area designated by the Engineer as not in accordance with the Specifications. The Geomembrane Installer shall be responsible for cleaning, sweeping, or other measures necessary to provide a thoroughly visible geomembrane surface for the Engineer's inspection. The Engineer's inspection shall be performed following a complete inspection and approval by the Geomembrane Installer's foreman or designated quality control technician.

3.08 WARRANTY

- A. The Contractor shall guarantee the integrity within the realm of the limitations of the Contractor's responsibility of the installed geomembrane for its intended use, from material or installation defects, for a period of two years from the date of acceptance.
- B. Such written warranty shall provide for the total and complete repair and/or replacement of any defect or defective areas of geomembrane upon written notification and demonstration by the Owner of the specific nonconformance of the geomembrane or installation with the Specifications. Such defects or nonconformance shall be repaired and/or replaced expeditiously, at no cost to the Owner.
- C. The Contractor shall be responsible for obtaining any necessary guarantees or certifications from the Geomembrane Manufacturer and Geomembrane Installer and submitting them to the Engineer and Owner prior to acceptance of the installed geomembrane.

Table 1, Section 13250

REQUIRED PHYSICAL PROPERTIES OF 40 MIL POLYPROPYLENE GEOMEMBRANE⁽¹⁾

PROPERTY (UNITS)	TESTING FREQUENCY	TEST METHOD ⁽²⁾	MIN/MAX VALUES
Thickness (mils)	each roll	ASTM D751	36-44
Specific Gravity, (g/cc)	each roll	ASTM D792, Method A-1	0.88 min
Carbon Black Content (%)	each roll	ASTM D1603	2.00 - 3.00
Minimum Tensile Properties, each direction	each roll	ASTM D638, type IV, specimen @ 2 ipm	
1. Tensile Stress @ Yield (lb/in.)	test in each principal sheet direction		N/A
2. Tensile Stress @ Break (lb/in.)			90 min
3. Elongation @ Yield (%)			N/A
4. Elongation @ Break (%)			600 min
Tear Resistance (pounds)	each roll	ASTM D1004, die C	14 min
Puncture Resistance (lbs)	each roll	ASTM D4833	45 min

NOTE (1): The required physical properties specified herein may be revised by the Engineer to reflect new or revised test methods or to conform with improvements to the state-of-the practice.

NOTE (2): Number of specimens per test established in applicable test method unless otherwise noted.

NOTE (3): Grading Observation Standard to be agreed upon between manufacturer and Engineer.

- END OF SECTION -

SECTION 13300

GEONET

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish all labor, material and equipment to install geonet including all necessary and incidental items, as shown on the Contract Drawings and these Specifications.
- B. No heat bonding of the geonet to the geotextile is required.

1.02 SUBMITTALS

- A. The results of the geonet hydraulic transmissivity testing performed by the geonet supplier shall be submitted to the Engineer with the Contractor's bid. At the time of contract award, two samples of the geonet, 1 yard square each, shall be furnished for possible confirmation testing by the Engineer.
- B. Prior to shipping to the site, the Contractor shall submit to the Engineer two copies of a mill certificate or affidavit signed by a legally authorized official of the manufacturer. The Contractor shall also submit one sample, one yard square in size, with the mill certificate for each material. The mill certificate and affidavits shall attest that the geonet meets the chemical, physical and manufacturing requirements stated in these specifications. The samples shall be labeled with the manufacturer's lot or batch number, machine direction, if applicable, date of sampling, project number, manufacturer and product name.
- C. The Contractor shall submit for the Engineer's approval, two full sets of field erection drawings showing panel layout for geonet. The erection drawings shall show panel lengths, locations, overlaps, method of securing joints, jointing to structures and attachments to penetrations as shown in the Contract Drawings.
- D. The Owner shall approve the shipping and delivery schedule prior to shipment. The Owner shall designate the on-site storage area for the geonet. The Contractor shall be responsible for unloading and storage of the geonet.
- E. The Contractor shall furnish the Engineer a copy of delivery tickets or other approved receipts evidence for materials received that will be incorporated into the construction.

PART 2 - MATERIALS

2.01 MATERIALS

- A. The geonet shall be manufactured from polyethylene having a minimum density of 0.92 gm/cc. Foamed geonets shall not be accepted. The geonet shall exhibit a hydraulic transmissivity of 1.0×10^{-4} m²/sec or greater at a normal compressive stress of 10,000 psf at a hydraulic gradient of 0.25 after a seating period of at least 100 hours. Testing shall be

in accordance with ASTM D4716 using the single normal compressive stress and hydraulic gradient stated above. Testing shall be conducted with the geonet specimen placed between two rigid plates. Testing shall be performed at no expense to the Owner.

PART 3 - EXECUTION

3.01 QUALITY ASSURANCE CONFORMANCE TESTING

- A. At the option of the Engineer, representative samples of the geonet shall be sampled and tested to assure that the material properties conform with these Specifications. Conformance testing will be conducted by the Engineer and paid for by the Owner.
- B. Conformance testing shall be completed at a minimum frequency of one sample per 100,000 square feet for the geonet delivered to the project site. Sampling and testing shall be as directed by the Engineer.
- C. Conformance testing of the geonet shall include, but not be limited to the following properties:
 - 1. Density, ASTM D792
 - 2. Melt Flow Index, ASTM D1238
 - 3. Thickness, ASTM D1777
- D. The Engineer may add to or revise the test methods used for determination of conformance properties to allow for use of improved methods.
- E. Conformance sampling of the geonet shall be completed on site by the Engineer.
- F. All geonet conformance test data shall meet or exceed requirements outlined in these Specifications prior to installation. Any materials that do not conform to these requirements shall be retested or rejected at the direction of the Engineer.
- G. Geonet that is rejected shall be removed from the project site and replaced at Contractor's cost. Sampling and conformance testing of the geonet supplied as replacement for rejected material shall be performed by the Engineer at the Contractor's cost.

3.02 INSTALLATION

- A. The geonet shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, the geonet shall be rejected, if it has defects, rips, holes, flaws, evidence of deterioration or other damage.
- B. The geonet shall be placed only on geomembrane that has been approved by the Geomembrane Installer and accepted by the Engineer. The Contractor shall coordinate with the Geomembrane Installer for optimum scheduling.
- C. The Contractor shall provide temporary anchorage of the geonet at the top of perimeter and interior berms during installation to prevent movement during construction. Such anchorage may include sandbags and the like, as approved by the Engineer. Permanent bonding to the geomembrane shall be prohibited.

- D. Adjacent rolls of geonet shall be overlapped a distance of at least 3-inches and secured using white polyethylene ties. For geonet placed on slopes, the ties shall be placed every 5-ft.

No end (transverse) geonet joints shall be constructed on landfill sideslopes or within 10 feet of the toe of the sidewall slope, except where accepted in advance by the Engineer.

- E. Any geonet that is torn, crushed or punctured shall be repaired or replaced by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of the same type of material, placed over the failed area and shall overlap the existing material a minimum of 12-inches from any point of the rupture. The patch shall be connected to the geonet using white polyethylene ties at a 5-ft spacing.
- F. The Contractor shall remove debris, including sediment to the degree possible, from the sump areas prior to placement of the geonet. The sump areas shall be accepted by the Engineer prior to geonet placement.
- G. Geonet shall be free of accumulated sediment, debris, etc., prior to installation of overlying geomembrane. The Contractor shall be responsible for removing accumulated sediment, etc., including, but not limited to sweeping, hosing, and inspection of the geomembrane and geonet in the affected areas.

- END OF SECTION -

SECTION 13400

GEOTEXTILES

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. For the proposed construction, only one geotextile type is specified: a Cushion Geotextile. The Cushion Geotextile will be installed around collector pipe drains and beneath aggregate to provide geomembrane protection.
- B. For the location of each type of geotextile see the Contract Drawings.
- C. The Contractor shall furnish and install all 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.

1.02 SUBMITTALS

- A. Prior to shipping to the site, the Contractor shall submit to the Engineer two copies of a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each type of Geotextile. The Supplier shall also submit three geotextile samples of each product, 1 yard square each, seamed and unseamed, with the mill certificate for each geotextile type supplied. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in the specifications. The samples shall be labeled with the manufacturer's lot number, machine direction, date of sampling, project number, specifications, manufacturer and product name.
- B. The Engineer shall be furnished copies of the delivery tickets or other acceptable receipts as evidence for materials received that will be incorporated into construction.

PART 2 - MATERIALS

2.01 MATERIALS

- A. The Filter Geotextile shall be a minimum 8-ounce per square yard nonwoven needle punched synthetic fabric consisting only of continuous filament polyester or polypropylene manufactured in a manner accepted by the Engineer and the Owner. The geotextiles shall be inert and unaffected by long-term exposure to chemicals or liquids with a pH range from 3 to 10. The geotextiles shall have a minimum threshold water head of 0.25-inches in the "as received" condition.
- B. The Cushion Geotextile shall be a minimum 16-ounce per square yard nonwoven needle punched synthetic fabric consisting only of continuous filament polyester or polypropylene manufactured in a manner accepted by the Engineer and the Owner. The geotextiles shall be inert and unaffected by long-term exposure to chemicals or liquids with a Ph range from 3 to 10.

- C. All geotextiles shall conform to the properties listed using the test methods listed in Table 1, Section 13400. The Contractor shall be responsible for timely submittals of all confirmation test data for Geotextiles at the time of bid submittal.

PART 3 - EXECUTION

3.01 SHIPPING, HANDLING AND STORAGE

- A. During periods of shipment and storage, all geotextiles shall be protected from direct sunlight, temperature greater than 140°F. water, mud, dirt, dust, and debris.

To the extent possible, the geotextile shall be maintained wrapped in heavy-duty protective covering until use. Geotextile delivered to the project site without protective wrapping shall be rejected.

- B. The Owner shall approve the shipping and delivery schedule prior to shipment. The Owner shall designate the on-site storage area for the geotextiles. Unloading and storage of Geotextiles shall be the responsibility of the Contractor.
- C. Geotextiles that are damaged during shipping or storage shall be rejected and replaced at Contractor expense.

3.02 QUALITY ASSURANCE CONFORMANCE TESTING

- A. At the option of the Engineer representative samples of Geotextiles shall be obtained and tested by the Engineer to assure that the material properties conform with these Specifications. Conformance testing shall be conducted by the Engineer and paid for by the Owner.
- B. Conformance testing shall be completed at a minimum frequency of one sample per 100,000 square feet of geotextile delivered to the project site. Sampling and testing shall be as directed by the Engineer.
- C. Conformance testing of the geotextiles shall include but not be limited to the following properties:
 1. Mass Per Unit Area (ASTM D3776)
 2. Thickness (ASTM D5199)
 3. Grab Tensile Strength (ASTM D4632)
 4. Burst Strength (ASTM D3786)
 5. Puncture Resistance (ASTM D4833)

The Engineer may add to, remove or revise the test methods used for determination of conformance properties to allow for use of improved methods.

- D. All geotextile conformance test data shall meet or exceed requirements outlined in Table 1, Section 13400 of these Specifications for the particular category of geotextile prior to installation. Any materials that do not conform to these requirements shall be retested or rejected at the direction of the Engineer.

Geotextile that is rejected shall be removed from the project site and replaced at Contractor's cost. Sampling and conformance testing of geotextile supplied as replacement for rejected material shall be performed by the Engineer at Contractor's cost.

3.03 INSTALLATION

- A. Geotextiles shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, the geotextile shall be rejected by the Engineer if it has defects, rips, holes, flaws, evidence of deterioration, or other damage.
- B. The Geotextiles shall be placed smooth and free of excessive wrinkles.
- C. When the Filter or Cushion Geotextiles are placed with upslope and downslope portions, the upslope fabric portion shall be lapped such that it is the upper or exposed geotextile.
- D. Geotextiles shall be temporarily secured in a manner accepted by the Engineer prior to placement of overlying materials.
- E. Overlaps of adjacent rolls of Filter or Cushion Geotextiles shall be at least 6-inches but not to exceed 12-inches. If heat bonding is used to join adjacent panels, the Contractor may reduce overlaps to 3-inches.
- F. Any geotextile that is torn or punctured shall be repaired or replaced as directed by the 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 12-inches from any point of the rupture.

TABLE 1 — REQUIRED GEOTEXTILE PROPERTIES*

GEOTEXTILE PROPERTY	FILTER GEOTEXTILE	CUSHION GEOTEXTILE
Geotextile Construction	Nonwoven Needlepunched	Nonwoven Needlepunched
Mass per Unit Area (Unit Weight), ASTM D3776 (oz/yd ²)	7.1	15.7
Ultraviolet Resistance, (500 hrs.) ASTM D4355, Average % Strength Retention	70	70
Grab Tensile Strength (lbs.), ASTM D4632	180	340
Grab Tensile elongation (%) ASTM D4632	50	50
Wide Width Tensile Strength, (lbs./in.) ASTM D4595	--	--
Burst Strength, ASTM D3786, Diaphragm Method (psi)	290	500
Apparent Opening Size (AOS), (mm), ASTM D4751	0.25	--
Permittivity at 50 mm constant head (sec ⁻¹), ASTM D4491	1.6	0.6
Puncture Resistance, ASTM D4833 (lb)	90	160

* Minimum Values, not Minimum Average Roll Value (MARV)

- END OF SECTION -

SECTION 13500

GEOSYNTHETIC CLAY LINER

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The General Contractor shall furnish and install the Geosynthetic Clay Liner (GCL) including all necessary and incidental items required to complete installation in accordance with the Contract Drawings and these Contract Specifications.

1.02 SUBMITTALS

- A. The Contractor shall be responsible for timely submittals of all Manufacturer's Quality Control (MQC) data at the time of bid submittal.
- B. Prior to shipment of GCL to the site, the Contractor shall submit to the Engineer two copies of a mill certificate or affidavit signed by a legally authorized representative of the GCL Manufacturer attesting that the GCL meets the requirements outlined in Tables 1 and 2, Section 13500 of these Contract Specifications.
- C. No GCL shall be approved for installation unless all required submittals have been provided to and approved by the Engineer.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Earthwork
- B. Geomembrane

PART 2 -- MATERIALS AND HANDLING

2.01 MATERIALS

- A. The GCL shall consist of new, first quality products designed and manufactured specifically for fluid containment within landfills, covers or surface impoundments.
- B. The GCL shall be a composite containing powdered bentonite and a geosynthetic backing and/or facing.
- C. The bentonite component shall consist of sodium bentonite meeting the minimum properties outlined on Table 1, Section 13500.

2.02 STORAGE AND HANDLING

- A. The Owner shall approve the shipping and delivery schedule prior to shipment. The Contractor shall prepare a suitable on-site storage area for the GCL.

- B. Each roll of GCL shall be individually packaged and protected to prevent damage to it during shipment. Each roll of the GCL shall be given prominent, unique, identifying markings indicating the sheet number, batch or lot number, and date of manufacture.
- C. The GCL shall be shipped in rolls and protected with a waterproof outside covering. Folded material shall not be accepted.
- D. During period of storage, the GCL shall be protected from moisture, direct sunlight, mud, debris, and excessive dust. The GCL shall be maintained in its waterproof covering until immediately before installation.

The GCL rolls shall be stored on pallets, blocks or otherwise prevented from direct contact with the ground surface during storage.
- E. The GCL shall be handled using a carpet pole or lifting bar placed through the core of the roll. The rolls shall not be loaded or transported by forklifts or slings unless the entire roll width is adequately supported.
- F. Any GCL that becomes damaged (including cracked, punctured or hydrated) during shipping, handling or storage shall be rejected, removed from the project site and replaced with new GCL at Contractor cost.

PART 3 -- EXECUTION

3.01 GCL INSTALLATION

- A. GCL shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, the GCL may be rejected by the Engineer if the GCL has evidence of defects, damage or becomes wet prior to covering.
- B. The surface receiving the GCL shall be prepared in accordance with the Geomembrane subgrade requirements outlined in these Contract Specifications.
- C. The Contractor shall coordinate placement of the GCL with the placement of the cover material to maintain the integrity of the GCL. Placement of overlying cover shall be closely sequenced with the installation of the GCL. Any material damaged prior to final acceptance of the project, whether due to weather or construction methods, shall be removed and replaced by the Contractor at Contractor expense.
- D. GCL shall not be placed on subgrade that has not been approved by the Engineer, on frozen subgrade, or over standing water. GCL shall not be installed during rainfall.
- E. GCL overlap and seaming shall be conducted in accordance with manufacturer's recommendations. Repair of small punctures, etc. shall be completed in accordance with manufacturer's requirements.

**TABLE 1 - REQUIRED PROPERTIES OF BENTONITE
COMPONENT OF GEOSYNTHETIC CLAY LINER (GCL)**

Bentonite Property	Test Method	Min/Max Values
Sodium Montmorillonite Content (%)	API Methylene Blue	70 min.
Free Swell (ml)	USP NFXVII	25 min.
Moisture Content (%)	ASTM D4643	20 max.
Moisture Absorption (%)	Enslin-Neff Test	300 min.

TABLE 2 - REQUIRED GEOSYNTHETIC CLAY LINER (GCL) PROPERTIES

GCL Property	Test Method	Min/Max Values
Bentonite Content (lb/sf)	Direct Measure	1 min.
Permeability	ASTM D5084	5×10^{-9} cm/sec max.

- END OF SECTION -

SECTION 15015

HIGH DENSITY POLYETHYLENE PIPE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. This section specifies high density polyethylene pipe (HDPE), fittings, and appurtenances.

1.02 QUALITY ASSURANCE

A. References

1. This section contains references to the following documents which are a part of this section, as specified and modified herein. In case of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM F714-89b	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM D1248-84(1989)	Polyethylene Plastics Molding and Extrusion Compounds
ASTM D3350-84	Polyethylene Plastics Pipe and Fittings Materials
ASTM D2837-88	Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D2657-87	Heat Joining of Polyethylene Pipe and Fittings

B. Testing

1. RESIN EVALUATION: All incoming resin shall be sampled and checked against test results supplied by the resin manufacturer. Samples shall be taken from the top and bottom of each compartment from every hopper car received.

All resin samples will undergo the following specification verifications:

- a. Melt index ASTM D2138.
- b. Stress exponent.
- c. Moisture content.
- d. Thermal stability ASTM D3350.
- e. Density ASTM D1505.

The results of these tests shall become part of the manufacturer's permanent quality control records.

2. **FINISHED GOODS EVALUATION:** Each length of pipe produced shall be checked by the production staff for the items listed below. The results of all measurements shall be recorded on production sheets which become part of the manufacturer's permanent records.
 - a. Pipe in process shall be checked visually, inside and out, for cosmetic defects (grooves, pits, hollows, etc.) which shall be cause for rejection.
 - b. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F714.
 - c. Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714.
 - d. Pipe length shall be measured.
 - e. Pipe marking shall be examined and checked for accuracy.
 - f. Pipe ends shall be checked to ensure that they are cut square and clean.
 - g. The inside surface shall be subjected to a "reverse bend test" to ensure that the pipe is free of oxidation (brittleness).

Stress regression testing shall be performed on all pipe by the manufacturer in accordance with ASTM D2837. Certification of stress regression test results shall be provided by the manufacturer.

1.03 SUBMITTALS

- A. The following submittals shall be provided in accordance with Section 01200:
 1. General piping layouts which include the location of all fittings, joints, connections to structures and manholes, liner seals, and couplings.
 2. Manufacturer's certification that the pipe meets all of the specifications.
 3. Design calculations for pipe thickness, bending stresses, and thermal stresses.
 4. Joint connection details.
 5. Fabricated joint details.

1.04 DESIGN CRITERIA

- A. Pressure and gravity piping shall have the dimensions indicated on the Contract Drawings and SDR shown on Table 1, Section 15015 of these Contract Specifications.

PART 2 -- PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. General

1. The pipe shall be manufactured from Type III, Category 5, Class C, Grade P34 polyethylene resin in accordance with ASTM D-1248. The SDR of the HDPE pipe shall be as shown on the Contract Drawings. HDPE pipe shall be as shown on the Contract Drawings. HDPE piping shall have smooth interior walls. The pipe shall be manufactured in accordance with ASTM F-714 and shall conform to cell classification PE 345434C for PE 3408 under ASTM D-3350.
2. The pipe material shall conform to the following cell classification requirements:

<u>Property</u>	<u>Value</u>	<u>ASTM Test Procedure Designation</u>
Density	0.955 gm/cm ³	D-1505
Melt Flow	0.1 gm/10 min.	D-1238
Flexural Modulus	133,000 psi	D-790
ESCR	No failures at 5,000 hrs (F ₀ >5000)	D-1693
Hydraulic Design Basis	1600 psi	D-2837
UV Stabilizer	2 - 3% carbon black	D-1603

3. The pipe shall contain no recycled materials or compounds.
4. Visible defects, such as cracks, creases, crazing, non-uniformly pigmented areas or undispersed raw materials shall not be acceptable and will result in rejection of the pipe by the Engineer.

B. Pipe Markings

1. HDPE pipe shall be marked either continuously or on intervals not to exceed five (5) feet by indirect printing with the following information:
 - a. Name and/or trademark of the manufacturer
 - b. Nominal pipe size
 - c. Dimension ratio
 - d. The letters PE followed by the polyethylene grade per ASTM D-1248, followed by the Hydrostatic Design basis in 100's of psi.
 - e. Manufacturing Standard Reference
 - f. Production Code from which time and date of manufacture can be determined.

2.02 FITTINGS

- A. See Section 15010 for pipe fitting specifications, where applicable.
- B. All fittings shall be flanged or have plain ends.

2.03 PERFORATIONS

- A. The 6-inch collection pipe shall be perforated as shown on the Contract Drawings. Allowable tolerance for hole dimensions shall be plus 1/16-inch on the diameter and plus 1/4-inch on the spacing. The rows shall be parallel to the pipe axis and spaced 120 degrees apart around the pipe circumference, plus or minus 5 degrees.

PART 3 -- EXECUTION

3.01 PIPE STORAGE

A. General

1. The Contractor shall store the HDPE pipe at the jobsite in accordance with the manufacturers recommendations. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging.

Outside surface: maximum allowable depth to cut, scratch, or gouge shall be 10 percent of wall thickness.

Inside surface: should be free of cuts, gouges, and scratches.

2. All HDPE pipe must be at the temperature of the surrounding soil at the time it is backfilled and compacted.

3.02 PIPE INSTALLATION

A. General

1. The pipe shall be installed at the locations and to the lines and grades as shown on the Contract Drawings.
2. The pipe bedding and backfill shall be as described in the Specifications and Contract Drawings. Blocking of the pipe is not permitted.
3. The pipe shall be handled in such a manner that the pipe is not damaged by dragging it over sharp or damaging objects. Sections of pipe which are damaged during handling or installation shall be removed and replaced at no cost to the Owner.
4. Under no circumstances shall the pipe be dropped into the trench.

TABLE 1 - HDPE PIPE SCHEDULE*

ITEM	DISCHARGE PIPE	
	DIAMETER (IN)	SDR
Perforated Collection Piping	6	17
Landfill Sump Discharge Piping	12	17
Landfill Exterior Leachate Discharge Piping	12	17

* Refer to Contract Drawings for pipe location, fittings and depth below Grade.

- END OF SECTION -

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management



James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

May 15, 1996

MEMORANDUM

TO: Sherri Coghill, Environmental Engineer

FROM: Bobby Lutfy, Hydrogeologist *BL*

RE: Halifax Coal Ash Landfill Proposed Cell 2 Expansion
Permit # 42-04

The revised drawings dated May 10, 1996, appear satisfactory. The new temporary monitoring well (MW-17) should be installed as close to the central part of the drainage feature as is reasonably possible. Generally shallow monitoring wells are to be constructed with 15 foot well screens set so that the top of the screen is located just above the seasonal high water table. However the top of the screen should never be set shallower than five feet from the ground surface. The well must be constructed in accordance with the N.C. Well Construction Standards, 15A NCAC 2C.

A copy of the Well Construction Record and Boring Log for the new well should be submitted to our office within 30 days of well completion. The new well must be installed prior to issuing the permit to operate for Cell 2. The list of sampling parameters for future sampling of the monitoring wells associated with the Ash Landfill should be changed to the parameters outlined in my letter of May 2, 1996, to Mr. John Bove of Hazen & Sawyer. (Static water level, well depth, pH, temperature, specific conductivity, turbidity, Total Organic Carbon, Chloride, Arsenic, Barium, Cadmium, Copper, Chromium, Lead, Mercury, Selenium, Silver, Sulfate, and Zinc.) Total (unfiltered) metals analyses are still required.

May 10, 1996

Sherri Coghill
Solid Waste Section
State of North Carolina Department of Environment,
Health and Natural Resources
P.O. Box 27687
Raleigh, NC 27611-7687



Re: Halifax County Coal Ash Monofill
Cell 2 Expansion
H&S No. 3786

Dear Ms. Coghill,

As a result of the meeting on May 2, 1996 with Bobby Lutfy and yourself, we are providing you with three copies of four revised drawings reflecting the new topographic survey and revised well locations. A summary of the revisions is provided below.

- | | |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Drawing G-1 | Revised to show the correct locations of existing Monitoring Wells MW-9 and MW-11 |
| Drawing G-2 | Revised to show the updated aerial topographic survey. |
| Drawing G-3 | Revised to show the updated aerial topographic survey as well as the resulting changes to the Intermediate Berm elevations and slope. |
| Drawing G-4 | Revised to show the 3H:1V Intermediate Berm exterior slope. |

The revised location of proposed temporary monitoring well MW-17 is also shown on Drawings G-2 and G-3. As we discussed, this will be the only temporary well required for Cell 2. We will drill the well as close as possible to the location shown. The final location will be established in the field based upon the actual toe of slope location. It will be as far as practical from the access road and out of the existing sediment basin.

We trust that the information submitted is responsive to your comments. If you have any questions or require additional information, please feel free to call us.

Very truly yours,

HAZEN AND SAWYER, P.C.



John A. Bove, P.E.
Senior Principal Engineer

Attachments: Revised Drawings

cc: Bobby Lutfy, Solid Waste Section (w/o attachments)
Mike Odle, Westmoreland - LG&E Partners (w/o attachments)
Hazen Blodgett, Halifax County (w/o attachments)

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management



James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

May 2, 1996

Mr. John Bove
Hazen & Sawyer
4011 WestChase Blvd.
Raleigh, N.C. 27607

RE: Halifax County Coal Ash Landfill Proposed Cell 2 Expansion
(Permit No. 42-04)

Dear Mr. Bove,

Thank you for the opportunity to meet with you today regarding the Halifax Ash Landfill proposed expansion. After further review, I think one temporary monitoring well will probably be sufficient for the Cell 2 development, if this well can be located in the vicinity of the drainage feature downgradient from existing well MW-14.

Based upon the waste stream for this ash landfill, I also think some of the sampling parameters could be changed. BOD, COD, TDS, TOX, Nitrogen, Fluoride, Iron, and Manganese can be deleted from the current monitoring list. Turbidity should be added to the current monitoring list. Therefore, in the future, all the monitoring wells associated with the Coal Ash Landfill should be sampled for the following parameters: static water level, well depth, pH, temperature, specific conductivity, turbidity, Total Organic Carbon, Chloride, Arsenic, Barium, Cadmium, Copper, Chromium, Lead, Mercury, Selenium, Silver, Sulfate, and Zinc. EPA Region IV is still requiring total metals analysis, so total (unfiltered) metals analysis continues to be required by the Solid Waste Section.

We will complete the review of the cell 2 expansion application as soon as the revisions are received in our office. If you have any questions about this letter, please call me at 733-0692, ext. 258.

Sincerely,

Bobby Lutfy, Hydrogeologist
Solid Waste Section

cc: Sherri Coghill, SWS

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director



February 12, 1996

Mr. John Bove
Hazen and Sawyer
4011 WestChase Blvd.
Raleigh, North Carolina 27607

RE: Permit Application, Halifax Co. Coal Ash Monofill Expansion,
Cell 2 Construction (Permit No. 42-04)

Dear Mr. Bove,

The Solid Waste Section Hydrogeologic Unit has reviewed the above referenced Permit Application for hydrogeologic concerns. Further discussion is needed on the revised ground-water monitoring system.

A discussion needs to be provided regarding the reasons for the location and design of the monitoring wells proposed. The Solid Waste Section would prefer to see the two new temporary monitoring wells located downgradient of the existing temporary monitoring wells (MW-13 & MW-14). Based upon the general ground-water flow and any possible geologic structural influence, it would appear best to keep these two wells in the same drainage swales as the existing wells.

The existing temporary monitoring wells and any other borings or piezometers in or near the footprint that are not to be used in the future need to be properly abandoned to ensure that the boreholes do not provide a more conductive pathway for the migration of potentially contaminated water. Please reference the "Procedures for permanent abandonment of wells", 15A NCAC 2C .0113(a)(2).

Mr. John Bove
Halifax Coal Ash Monofill
Page 2

Please provide a revised monitoring plan as soon as possible so the Solid Waste Section can complete our review of the Permit Application for Cell 2. If you have any questions about this letter, you may contact me at (919) 733-0692, extension 258.

Sincerely,

Bobby Lutfy

Bobby Lutfy
Hydrogeologist
Solid Waste Section

cc: Sherri Coghill, Solid Waste Section
Ben Barnes, SWS - Raleigh Regional Office
Hazen Blodgett, Halifax County

HAZEN AND SAWYER
Environmental Engineers & Scientists

42-04
Hazen and Sawyer, P.C.
4011 WestChase Blvd.
Raleigh, NC 27607
919 833-7152
Fax: 919 833-1828

February 16, 1996

Sherri Coghill
Solid Waste Section
State of North Carolina Department of Environment,
Health and Natural Resources
P.O. Box 27687
Raleigh, NC 27611-7687

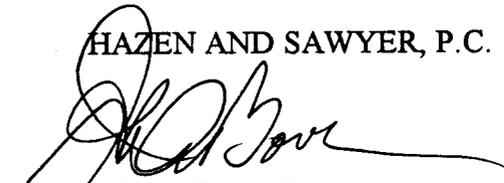
Re: Halifax County Coal Ash Monofill
Cell 2 Expansion
H&S No. 3786

Dear Sherri,

As we discussed, here is another copy of the specifications. I apologize about the condition of the last set we sent you. Please call if you have any questions.

Very truly yours,

HAZEN AND SAWYER, P.C.

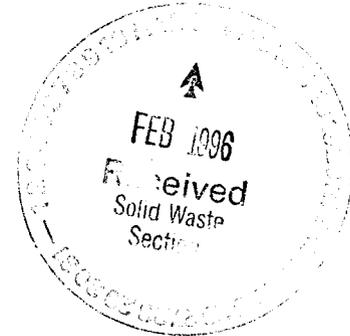


John A. Bove, P.E.
Senior Principal Engineer

Attachments: Specifications

February 9, 1996

Sherri Coghill
Solid Waste Section
State of North Carolina Department of Environment,
Health and Natural Resources
P.O. Box 27687
Raleigh, NC 27611-7687



Re: Halifax County Coal Ash Monofill
Cell 2 Expansion
H&S No. 3786

Dear Ms. Coghill,

In response to your review comments for the above referenced facility, please find the following attached information:

1. Construction Quality Assurance Plan
2. Specifications, and
3. Three sets of revised drawings.

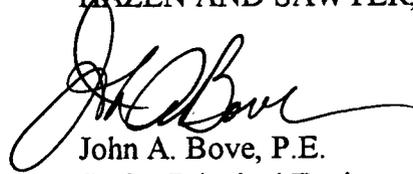
The review letter dated January 23, 1996 contained three comments on our October 12, 1995 submittal. A brief response to each comment is provided below.

1. We have revised the April, 1992 CQA Plan to include the Polypropylene (PPE) geomembrane. Specifications for the main elements of construction, including earthwork, pipe and geosynthetics, are provided.
2. The note on Drawing G4 has been revised to be consistent with the detail, as requested. In addition, we have decided to specify 40 mil PPE instead of the 30 mil PPE material due to the availability of the 40 mil from several vendors. This change has been reflected on several of the drawings. For convenience, we have submitted three complete sets of updated drawings.
3. The rubsheet will be 40 mil Polypropylene, just like the rest of the geomembrane. The drawings have been revised to clarify this.

We trust that the information submitted is responsive to your comments. If you have any questions or require additional information, please feel free to call us.

Very truly yours,

HAZEN AND SAWYER, P.C.

A handwritten signature in black ink, appearing to read "John A. Bove". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

John A. Bove, P.E.
Senior Principal Engineer

Attachments: CQA Plan
Specifications
Revised Drawings

cc: Mike Odle, Westmoreland - LG&E Partners (w/o attachments)
Hazen Blodgett, Halifax County (w/o attachments)

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director



February 7, 1996

Mr. John Bove
Hazen and Sawyer
4011 WestChase Blvd.
Raleigh, North Carolina 27607

RE: Permit Application, Halifax Co. Coal Ash Monofill Expansion,
Cell 2 Construction (Permit No. 42-04)

Dear Mr. Bove,

The Solid Waste Section Hydrogeologic Unit has reviewed the above referenced Permit Application for hydrogeologic concerns. There is little hydrogeologic data or discussion in the Permit Application.

Hydrogeologic data and discussion needs to be presented that demonstrates that the proposed design grades are maintaining the minimum four foot vertical separation from top of bedrock and/or the long-term seasonal high water table levels. A drawing for the area in and around Cell 2 needs to be submitted that shows the locations of all borings, piezometers, and monitoring wells and the proposed subgrade elevations. A ground-water contour map should be submitted for this area. All relevant boring logs, piezometer construction records, well completion records, etc. also need to be included in the report. Tables of water table elevations and a projection of long-term seasonal high water table elevations must be provided.

Discussion is needed on the reasons for the location and design of the monitoring wells proposed for the revised monitoring system necessary due to the construction of Cell 2. A proposed sampling and analysis plan is also necessary.

Mr. John Bove
Halifax Coal Ash Monofill Expansion
Page 2

The Permit Application must include the information referenced above before the Section can complete a technical review. If you have any questions or comments about this letter, please call me at (919) 733-0692, extension 258.

Sincerely,

Bobby Lutfy

Bobby Lutfy
Hydrogeologist
Solid Waste Section

cc: Sherri Coghill, Solid Waste Section
Ben Barnes, SWS - Raleigh Regional Office
Hazen Blodgett, Halifax County

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director



January 23, 1996

Mr. John A. Bove, P.E.
Hazen and Sawyer
4011 WestChase Blvd.
Raleigh, North Carolina 27607

Re: Construction Plan Modifications
Halifax County Ash Monofill
Permit No. 42-04

Dear Mr. Bove:

The Solid Waste Section has conducted a preliminary review of the referenced modifications. The following comments must be addressed in order to continue the review process:

1. Please revise specifications for monofill construction to include the desired material and construction modifications. Also, provide CQA specifications for liner and stormwater collection.
2. Correct discrepancy between notes and figures presented in Section B/G3 regarding encapsulations of coal ash structural fill in access road.
3. Provide material specifications for 15' wide geomembrane rub sheet.

If you have any questions regarding this correspondence, please contact me at (919) 733-0692, ext. 259.

Sincerely,

Sherri Coghill
Environmental Engineer
Solid Waste Section

cc: Terry Dover
Jim Barber
Ben Barnes