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Wilson | 9/6/07 | RCO 2997

G.N. RICHARDSON & ASSOCIATES
Engineering and Geological Services

Preliminary submittal - NOT APPROVED

Received
NOV 2006
Solid Waste
Section

November 21, 2006

Mr. Edward F. Mussler, P.E.
NC DENR - Division of Waste Management
401 Oberlin Road, Suite 150
Raleigh, NC 27605

RE: Johnston County Landfill (Permit No. 51-03)
Permit Modification Request
Modification of Existing Leachate Storage Pond for use as Equalization Basin

Dear Ed:

On behalf of Johnston County, G.N. Richardson & Associates, Inc. (GNRA) would like to submit this permit modification request for the modification of the existing leachate storage pond for use as an equalization basin for raw wastewater. Attached to this letter request is a copy of a study prepared by Dewberry & Davis, Inc. (Dewberry) which describes the need and conceptual design of the proposed improvements from a wastewater perspective.

Existing Leachate Storage Pond

The existing leachate storage pond has an approximate capacity of 4.2M gallons with 2 feet of freeboard. This lined storage pond was constructed in 1998 in conjunction with the construction of the site's initial Subtitle D landfill unit (Phase 5). Due to the large size of the pond and typical leachate generation at the site (between 1.26M and 3.05M gallons per year based on 2004 and 2005 data), the capacity of this pond has been very much underutilized.

Modified Capacity for Leachate Storage

As described in the Dewberry study, a volume of approximately 850,000 gallons will be maintained in the pond (below the required 2 feet of freeboard) under typical conditions. This capacity is much greater than the anticipated 300,000 surge volume from a newly operational landfill unit (reference C&D Landfill - Area 2 Cell 1 Permit to Construct). Additionally, considering the very large pumping capacity (two 1,300 GPM pumps) of the existing raw sewage pump station which will be connected to the pond, the ability to handle leachate generation at the site is very high.

The modified capacity and/or operation of the leachate pond will not affect the County's ability to draw-down the pond in advance of predicted heavy rainfall (tropical storm, hurricane, etc.).

General Modifications for Leachate

As shown on Figure 4-5 of the Dewberry study, the existing leachate gravity line will be routed directly to the existing leachate pump station instead of into the pond. Additionally, the existing inlet and outlet pipes into and out of the pond will be closed off by placing normally closed valves on existing inlet and outlet pipes such that raw wastewater will not mix with leachate in the leachate pump station. These valves would only be opened in the event that the raw sewage pump station would need to be shut down and leachate generation was in excess of what the existing leachate pump station/force main could handle (an unlikely event). An overflow line will be added to the leachate pump station to route excess leachate

to the raw sewage pump station. The raw sewage pump station will be connected to the pond with a new 16-inch gravity line.

Layout of Facility

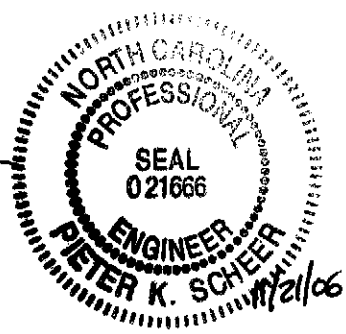
The layout of the proposed and conceptual future modifications will be on the southwest side of the existing leachate pond. The actual location will be selected to minimize the impact to the future landfill footprint in this vicinity. Thus, no change to the permitted landfill capacity is anticipated as the result of this modification request.

Leachate Recirculation

The proposed modifications will still allow leachate to be recirculated from the existing leachate pump station if desired by the County. In the future, the County may decide to add a leachate storage tank for the specific purpose of maintaining a steady volume of leachate for recirculation. Conceptually, a 50,000 gallon tank would be used for this purpose as described in the Dewberry report. If this is desired, the County will submit plans for the storage tank to DWM for review and approval.

Should you have any questions or comments on this submittal or require further information, please contact me at your earliest convenience.

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



Pieter K. Scheer, P.E.
Project Manager

Attachment: Landfill Equalization Basin Study (Dewberry)

cc: Tim Broome, P.E., Johnston County
Haywood Phthisic, Johnston County
Rick Proctor, Johnston County
Amanda Bader, P.E., Dewberry

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Landfill Equalization Basin Study

Preliminary Submittal - NOT APPROVED

JOHNSTON COUNTY
NORTH CAROLINA

Prepared For:

Johnston County Public Utilities
P.O. Box 2263
Smithfield NC 27577

Project No.: 50000728

SEPTEMBER 2006
REVISED NOVEMBER 2006

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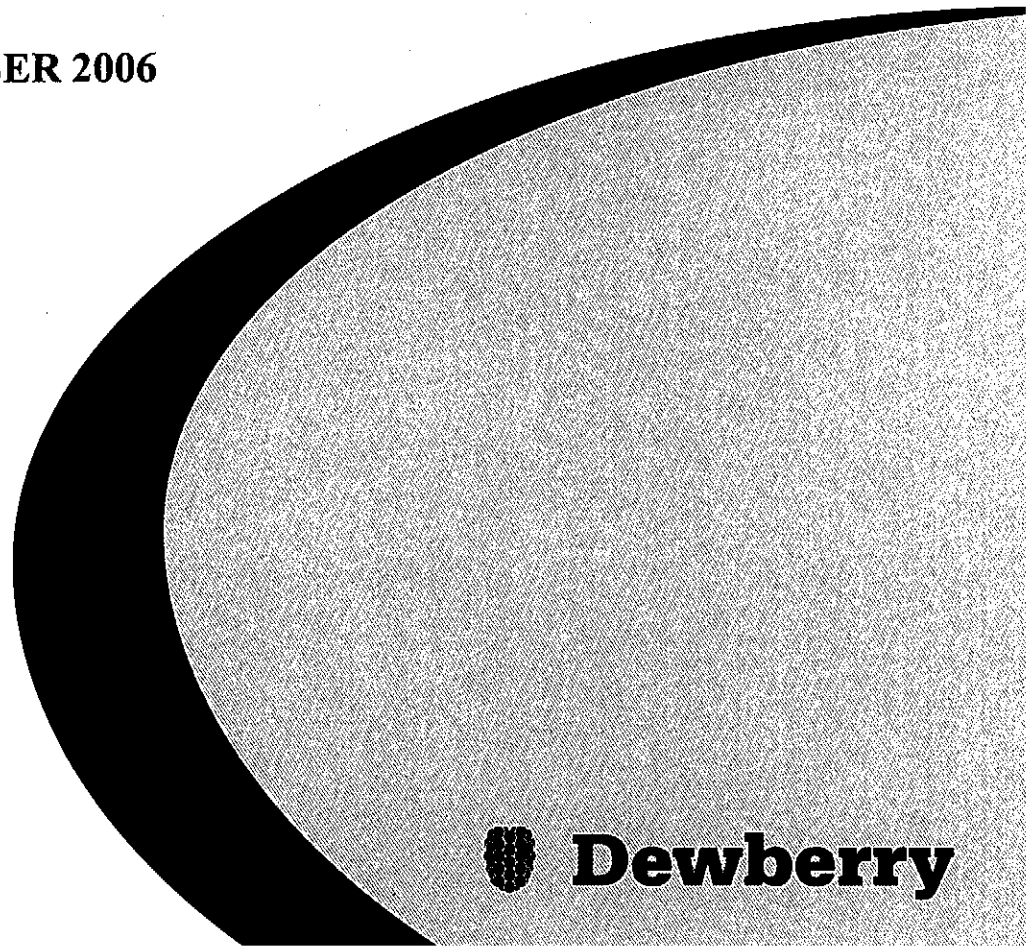

Landfill Equalization Basin Study

JOHNSTON COUNTY
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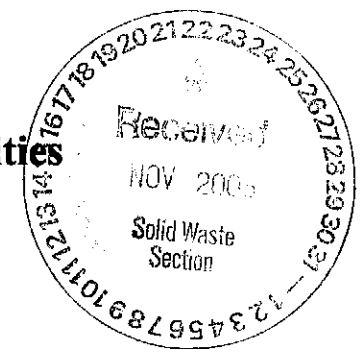

Project No.: 50000728

SEPTEMBER 2006
REVISED NOVEMBER 2006

11/21/06

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1. INTRODUCTION

Johnston County operates a landfill leachate collection basin that is currently underutilized. The basin is lined with a synthetic membrane and concrete mat and aerated with four 25 HP floating aerators. The County wishes to permit the basin to operate as an equalization basin for raw wastewater flow as part of the McGee's Crossroads and Cleveland Area Diversion Wastewater Facilities. In order to further maximize the potential use of existing infrastructure, the County wishes to look at the conjunctive use of the existing leachate collection basin for landfill leachate storage and raw wastewater equalization during landfill phases where recirculation of leachate is not used.

The need for an equalization basin is described in the County's Engineering Report dated November 2005 (Revised January 2006). The report includes the construction of a flow equalization facility at the Landfill Raw Sewage Pump Station to reduce peak flows to the capacity of the existing 12" force main.

The landfill leachate collection basin is part of the landfill leachate collection system which includes collection piping, a collection pump station, a recirculation pump station and recirculation piping. The recirculation system is designed only for Cell 5 at this time. The system is currently not used due to the potential for leachate breakout in the very top zone of the cell. Leachate recirculation is being discontinued until Cell 5 is capped (under the closure plan) and/or a recirculation system is designed and permitted for Cell 4A. Upon completion of the recirculation system for Cell 4A, leachate recirculation operation will resume in accordance with the landfill's facility plan requirements.

G.N. Richardson & Associates (GNRA) has provided a preliminary estimate for storage of 50,000 gallons for a separate leachate storage tank for future operation of landfill leachate recirculation. If leachate recirculation is resumed, the County proposes to incorporate a separate storage tank in the leachate recirculation system. If leachate recirculation were subsequently eliminated, then the leachate storage tank could be converted to a clarifier and incorporated into a reclaimed water treatment plant under consideration for construction on the landfill site.

2. EXISTING FACILITIES

A schematic of existing facilities is shown in Figure 4-1. Two existing systems are generally categorized into Leachate Collection and Recirculation and Raw Sewage (RS) Pumping. Design parameters used for the purpose of this study for these two (2) systems are as follows:

Leachate Collection and Recirculation System

Pump Station

- Year of installation – 1998
- Duplex submersible
- Level and flow control
- 4" magnetic flow meter
- Six foot diameter wetwell
- Pump station can recirculate leachate to landfill cell (3" FM) or pump to existing raw sewage pump station (6" FM)

Leachate Collection Basin

- 4.2 MG total capacity
- Synthetic liner overlaid with concrete matting
- (4) 25 HP Aerators

Raw Sewage (RS) Pumping

Onsite RS pump Station

- Two (2) 1,300 GPM pumps
- Ten foot diameter wet well
- Level and flow control
- One (1) spare slot for future pump installation if required
- 12" PVC force main to wastewater treatment plant

Flows tributary to Onsite RS Pump Station

- Flows received directly from off-site pump stations. Offsite pump stations and capacity are listed below.

McGees Crossroads Area Pump Stations	
West Johnston High School	80 gpm
McGees Crossroads Schools	180 gpm
319 Pump Station	180 gpm
Subtotal Peak Capacity	440 gpm
Subtotal Peak Capacity	0.64 MGD
Cleveland Area Pump Stations	
Jordan Ridge	2,575 gpm
Wells Fuller	350 gpm
The Pointe	315 gpm
Subtotal Peak Capacity	3,240 gpm
Subtotal Peak Capacity	4.67 MGD
Total Peak Capacity	**3,680 gpm**
Total Peak Capacity	**5.31 MGD**

3. PROJECTED FLOWS AND DESIGN PARAMETERS

Leachate

A projection of leachate storage volume is not within the scope of this project. G.N. Richardson & Associates (GNRA) has advised Dewberry that a 50,000 gallon storage tank will be required for the operation of the leachate recirculation system.

Raw Wastewater/Sewage

The combined peak pumping capacity of the off-site pump stations that are transferring raw wastewater to this site is 5.31 MGD. Currently average daily flow being transferred by these pumps total 0.25 – 0.35 MGD.

Based on projections previously made by Johnston County, with consideration of full development of the planning area, an average daily flow (ADF) of 1.3 MGD is anticipated.

Combined Flows – Leachate and Raw Wastewater/Sewage

Prior to construction of the new landfill cell, the equalization basin will be designed to store leachate and wastewater. Currently, leachate is not being recycled to the existing landfill and will not be recycled until the new cell is constructed.

In 2004, the average daily flow of leachate was approximately 3,400 gpd and in 2005, the average daily flow of leachate was approximately 8,250 gpd based on the leachate pump station operation log pump run times. These average daily flows for leachate represent 1.2% to 2.5% of the combined wastewater/leachate ADF proposed for the basin given a current ADF of 250,000 gpd for the wastewater flow.

Based on a May 2005 analysis of the leachate, BOD concentration of the leachate was 64 mg/l and the COD concentration was 294 mg/l. The laboratory results reporting volatile organics and inorganics is located in the Appendix. Leachate concentration can be highly variable depending on the state of decomposition of the refuse cells. Therefore, it is essential to provide storage for flow as well as leachate strength equalization.[1] An EPA summary of six (6) independent studies, July 1988, reported a BOD_5 range from 7 to 29,000 mg/l with an average of 3,837 mg/l. The COD average for this data is 4,773 mg/l.[2]

4. PROPOSED IMPROVEMENTS

4.1 General

As discussed in the introduction of this report, the primary goal of Johnston County is to convert the existing leachate holding basin into a raw wastewater flow equalization basin which also receives and pretreats leachate. Further, if the County chooses to resume leachate recirculation in the future, a separate storage tank would be constructed to isolate and store leachate to be recirculated.

Secondly, consideration must be given in the design of these related new facilities to enhance the ability to conduct a second future phase of work during which equalized raw wastewater would be diverted to a biological treatment system and converted to reclaim water (RCW).

4.2 Phase I – Equalization Basin

Figures 4-1, 4-2, and 4-4 illustrate in schematic form and profile the improvements that are proposed to meet operational objectives noted above. Figure 4-5 shows the piping modifications required for Phase I.

The proposed improvements for Phase I are shown in Figure 4-1. This phase involves the conversion of the 4.2 MG leachate basin to an equalization basin. The proposed improvements are:

- (1) New Mechanical Screen (Fine – ¼", 6 mm) with Screening Compactor
- Piping modifications to gravity and pressure pipe
- Modification of controls at the existing RS pump station
- Replacement of the existing generator

Screening equipment will include a conventional continuous belt self-cleaning screen. A screening compactor will wash, compact and convey screenings to a dumpster. A concrete pad with sump pump will be provided upon which the dumpster will be located. Elevations as established in Figure 4-2 for this screen installation are approximate only and must be verified by field survey prior to final design. The screen would be designed to handle the peak influent flow from the off-site pump stations which would be equivalent to 5.31 MGD.

Piping modifications will enable the conveyance of leachate to either the EQ basin, the RS pump station, or the leachate pump station. A float switch will be added to the leachate pump station so the pump can operate automatically depending on liquid level in the wet well. In the event leachate recirculation is used, leachate will be bypassed directly to the leachate pump station by closing valves to separate wastewater and leachate flows. Wastewater and leachate flows will not be mixed during leachate recirculation.

Operation of the equalization basin will require the addition of a continuous level transmitter (ultrasonic or bubbler) to monitor the level in the basin and enable/disable the RS pump station accordingly. A timer is recommended to override the basin level to enable the RS pump station to come on only at pre-selected time periods and to run only for a pre-selected time interval for low flow periods. The pumps can be programmed to operate only during low flow periods at the main WWTP and for a duration that will limit maximum volume of pumped flow for any particular 24 hour period if required.

A maximum of 1 foot of level in the basin equates to 0.85 MG and will conservatively provide 100% equalization of future proposed flows.

The basin will provide adequate volume for equalization as well as leachate storage volume based on 2004 and 2005 average daily flow data for leachate. The existing concrete mat and 60 mil HDPE liner meet the state requirements for the liner permeability.

Calculations further indicate that mixing requirements for this basin is approximately 80 HP whereas oxygen transfer required for BOD and potential nitrogenous reduction is 50 HP. This compares to an existing combined surface aerator equal to 100 HP. The current horsepower in the basin has a safety factor of 2 to account for the potential additional organic loading from the landfill leachate (e.g., assuming a leachate flow of 8,000 gpd and a BOD_5 of 5,000 mg/l the associated aeration demand is 7 HP as compared to 50 HP in reserve.) No change in aeration capacity will be required at this time. In the future the County can add an additional aerator if required.

Modifications to the aerator control system are recommended to enable proper sequencing of these aerators to achieve power savings during low flow conditions and for backup power startup if the aerators are to be operated during a power outage.

At current average daily flows (ADF) of 0.3 MGD versus the projected 1.3 MGD design, the equalization basin will have effective retention times of 12 days and 3 days respectively. Due to this relatively long detention time that will be provided in the existing basin, a significant amount of biological degradation of the raw wastewater will occur. The mixing of the raw wastewater with leachate will provide leachate strength equalization. The leachate strength equalization and long detention time will provide an advantage for the microorganisms to acclimate to the leachate characteristics. Resulting BOD reduction and steady state mixed liquor, suspended solids (MLSS) are estimated as follows:

Flow MGD	HRT (d)	BOD inf. mg/l	BOD eff. (mg/l)	MLSS conc. (mg/l)
0.3	12 days	220	5	61
1.0	4 days	220	14	86

Though a major reduction in oxygen demand will occur in the equalization basin, a significant oxygen uptake rate resulting from endogenous decay of biomass is expected to produce septic conditions in the relatively long 12" force main to the WWTF. Because this force main is PVC and conveys wastewater directly to the WWTF, potential for corrosion from septic wastewater or significant odor production is not expected to be of concern. Existing air release valves may need to be replaced with plastic models that are resistant to corrosion.

Based on historical data and findings in this report, it is not anticipated that high COD or organic loading will be an issue for the leachate pretreatment. In the future, as new cells are developed and leachate characteristics change, additional wastewater flows are expected to be present for adequate dilution of the leachate.

Calculations for the generator sizing are included in the appendix of this report. Five aerators were used for this analysis to account for the addition of another aerator in the equalization basin if required in the future. The components that the proposed generator would operate include:

- One (1) 150 HP RS Pump with existing soft starter
- Five (5) 25 HP aerators (optional)
- One fine screen and compactor (Total 5 HP)

Using Caterpillar sizing software, three scenarios were evaluated. One scenario includes starting the five aerators with soft starters. This scenario requires a 250 KW generator set with a cost of $56,000 for the generator set only. Another scenario includes starting the five aerators across the line. This scenario requires a 300 KW generator set with a cost of $60,000 for the generator set only. The third scenario includes starting only one existing 150 HP pump with no aerators. Calculations indicate that a 200 KW generator will operate one pump. Further evaluation of the existing 200 KW generator may be required to confirm the alternator sizing and voltage dip.

4.3 Phase I – Alternate – Leachate Tank

The proposed improvements for Phase I – Alternate include the addition of a 50' diameter leachate tank and all associated piping. Figures 4-1, 4-3, and 4-4 depict the proposed improvements needed to meet operational objectives. Figure 4-5 shows the necessary piping modifications needed for Phase I – Alternate.

Calculations included in the appendix of this report indicate that for a future 1.0 MGD reclaimed water treatment system with a 1.5 MGD peak flow, one (1) 50' diameter clarifier will be required. Alternately, two (2) 35' diameter clarifiers could be used. The volume for a 50' diameter clarifier would provide approximately 100,000 gallons for leachate storage.

At 50' diameter, a sidewall water operating level of 7' will be recommended to provide appropriate elevations for the hydraulics of the leachate system. These elevations will allow proper operation of the tank relative to the normal operating level and the desired overflow elevation within the leachate pump station. Raising the bottom is possible to decrease the depth of the clarifier but may be detrimental with regard to the height of the upstream water reclamation treatment units once the clarifier is built out to the 14' side water depth. The tank depth at this elevation will also provide the capability to add surface aeration if it is ever determined to have any benefit in the future.

4.4 Phase II – Reclaimed Water Treatment System

A detailed review of a second future phase of construction involving construction of a biological wastewater treatment plant to treat equalized wastewater for reclaimed production is beyond the scope of this study. Figure 4-1and 4-4 show schematic layouts for the Phase II work.

Figure 4-3 illustrates the extension of the leachate tank sidewalls and construction of effluent troughs in converting this tank to a clarifier. Figure 4-1 provides a preliminary schematic of the RCW treatment facility and related treatment units.

In accordance with NC T15A: 02H.200 regarding treatment requirements for reclaimed water production, the following treatment standards apply:

- Tertiary filtration
- TSS $\leq$ 5 mg/l (Monthly Avg), 10 mg/l (Daily Max)
- Turbidity <10 NTU
- Fecal $\leq$ 14/100 ml (Monthly Avg), 25/100 ml (Daily Max)
- BOD $\leq$ 10 mg/l (Monthly Avg), 15 mg/l (Daily Max)
- $NH_3 \leq 4$ mg/l (Monthly Avg), 6 mg/l (Daily Max)
- 25% ADF minimum equalization in front of treatment system

The Phase II improvements will involve partitioning of the equalization basin with an internal berm and utilizing only a portion of this basin to achieve flow equalization. The location for a future RCW treatment system is indicated in Figure 4-4.

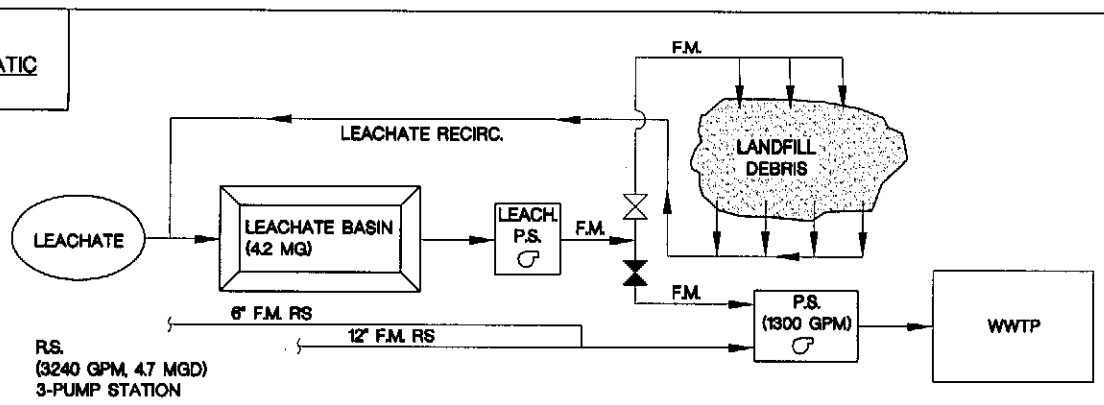
It is not recommended that the entire basin be used for equalization because of the long detention times and resulting partial biological activity that will occur. Equalization that will be provided by the partitioned basin will provide for consistent waste characteristics and equalized flow to the

RCW biological treatment unit(s). Downsizing of clarifiers and tertiary filters will also be possible with the continued use of the partitioned equalization basin.

Because of the stringent treatment limits associated with reclaimed water treatment it is recommended that new biological reactors be used in lieu of using the existing basin as a biological reactor. New reactors will provide better treatment with better geometry, mixing, higher efficiency, and more consistent solids inventory with the absence of dead zones and long sludge age.

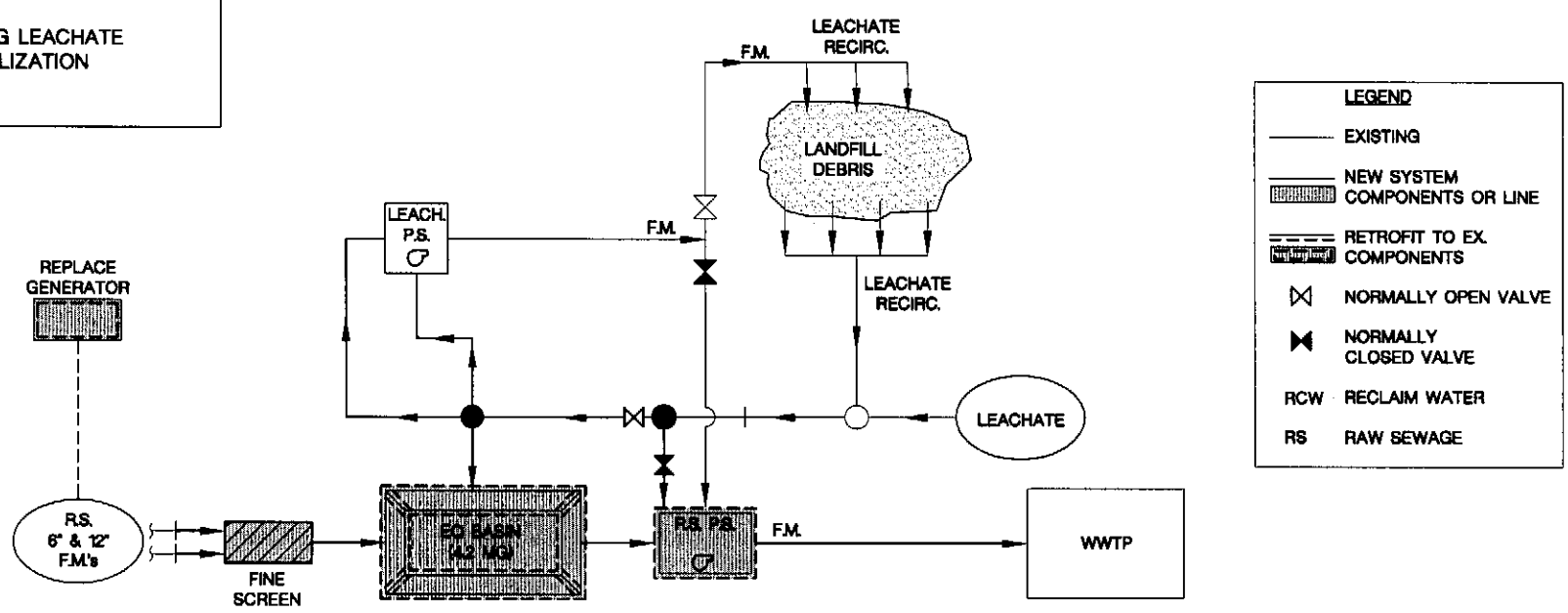
Another option that may provide some cost savings is to partition a portion of the existing basin for the aeration process unit and operate in extended aeration mode. Potential issues with this option include lack of depth for mixing, pumping required for conveyance of flow from the equalization portion of the basin to the reactor portion of the basin, and pumping required from the reactor to the clarifier.

EXISTING FLOW SCHEMATIC



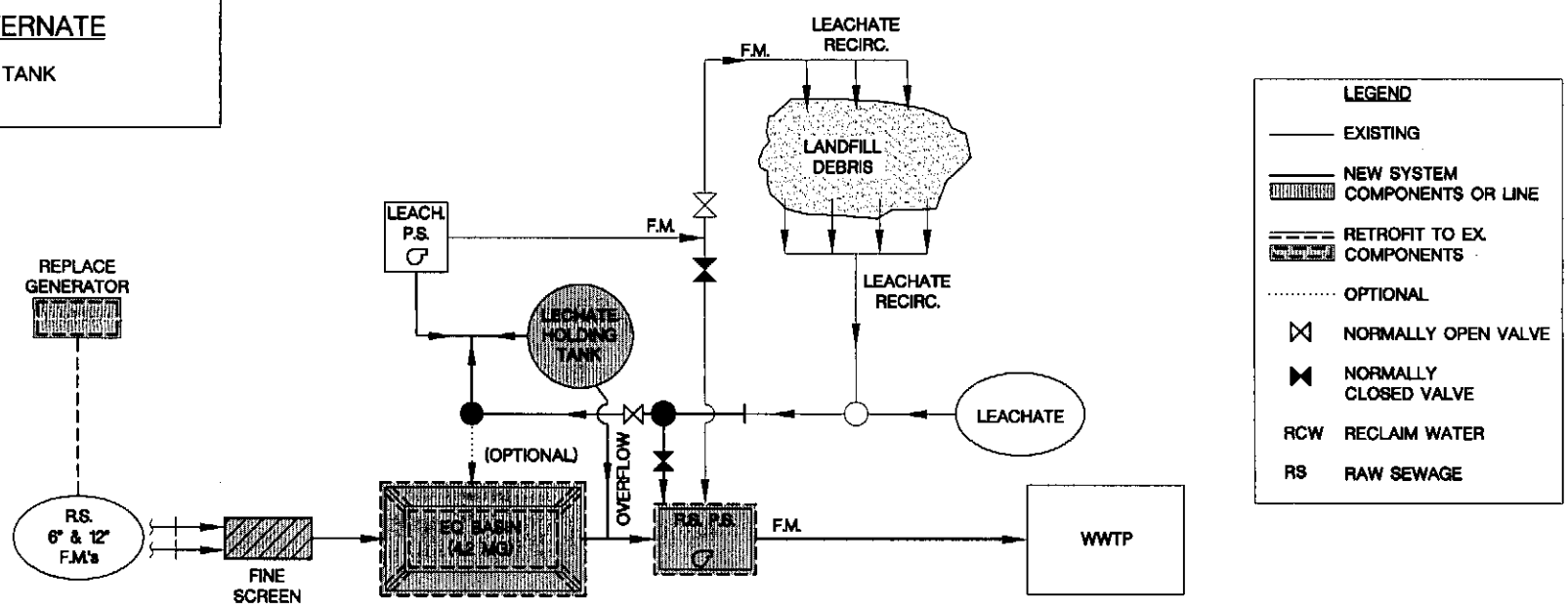
PHASE I

CONVERT 4.2 MG LEACHATE BASIN TO EQUALIZATION BASIN



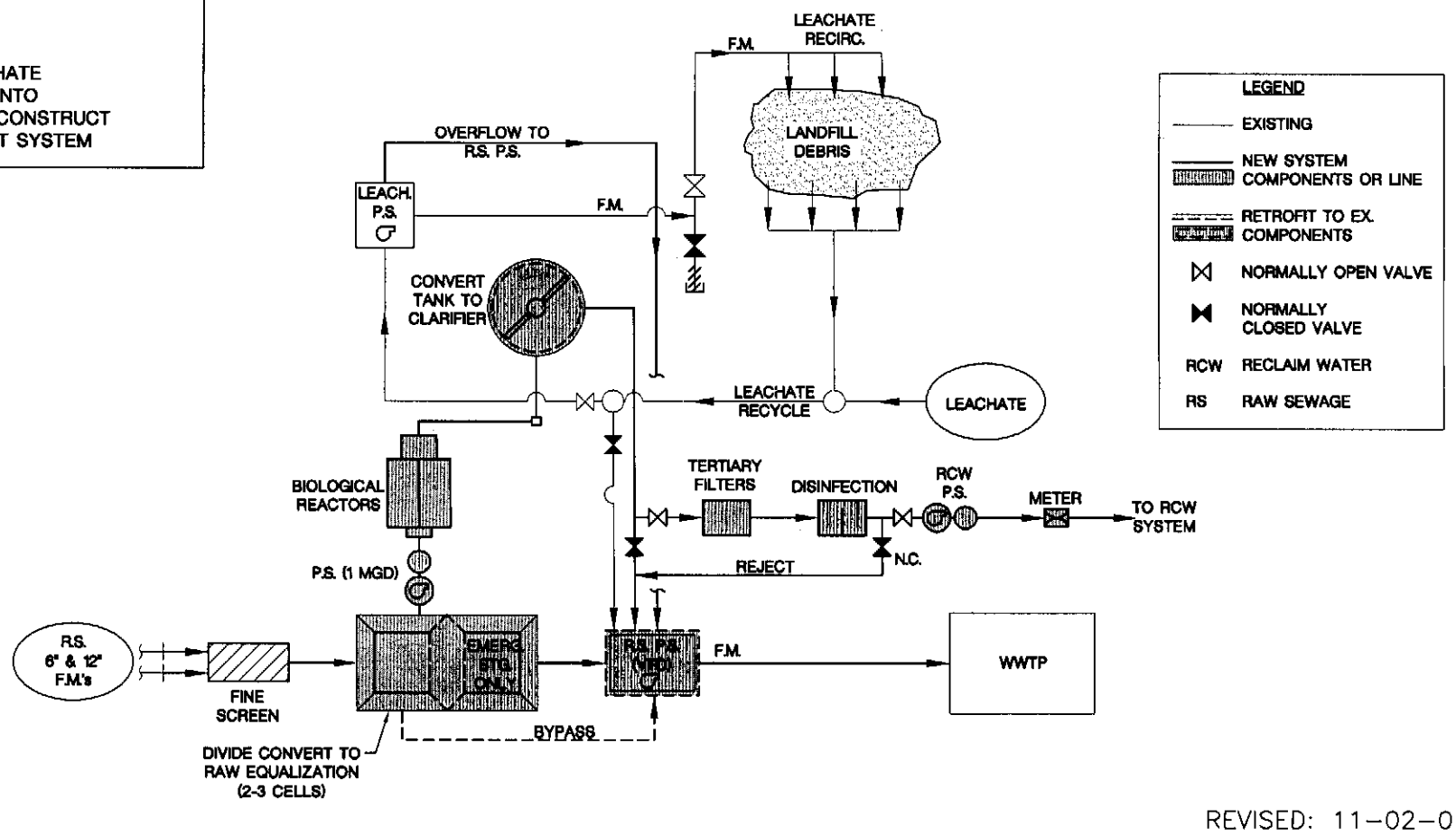
PHASE I-ALTERNATE

NEW LEACHATE TANK



PHASE II

CONVERT LEACHATE HOLDING TANK INTO CLARIFIER AND CONSTRUCT RCW TREATMENT SYSTEM



REVISED: 11-02-06

Dewberry

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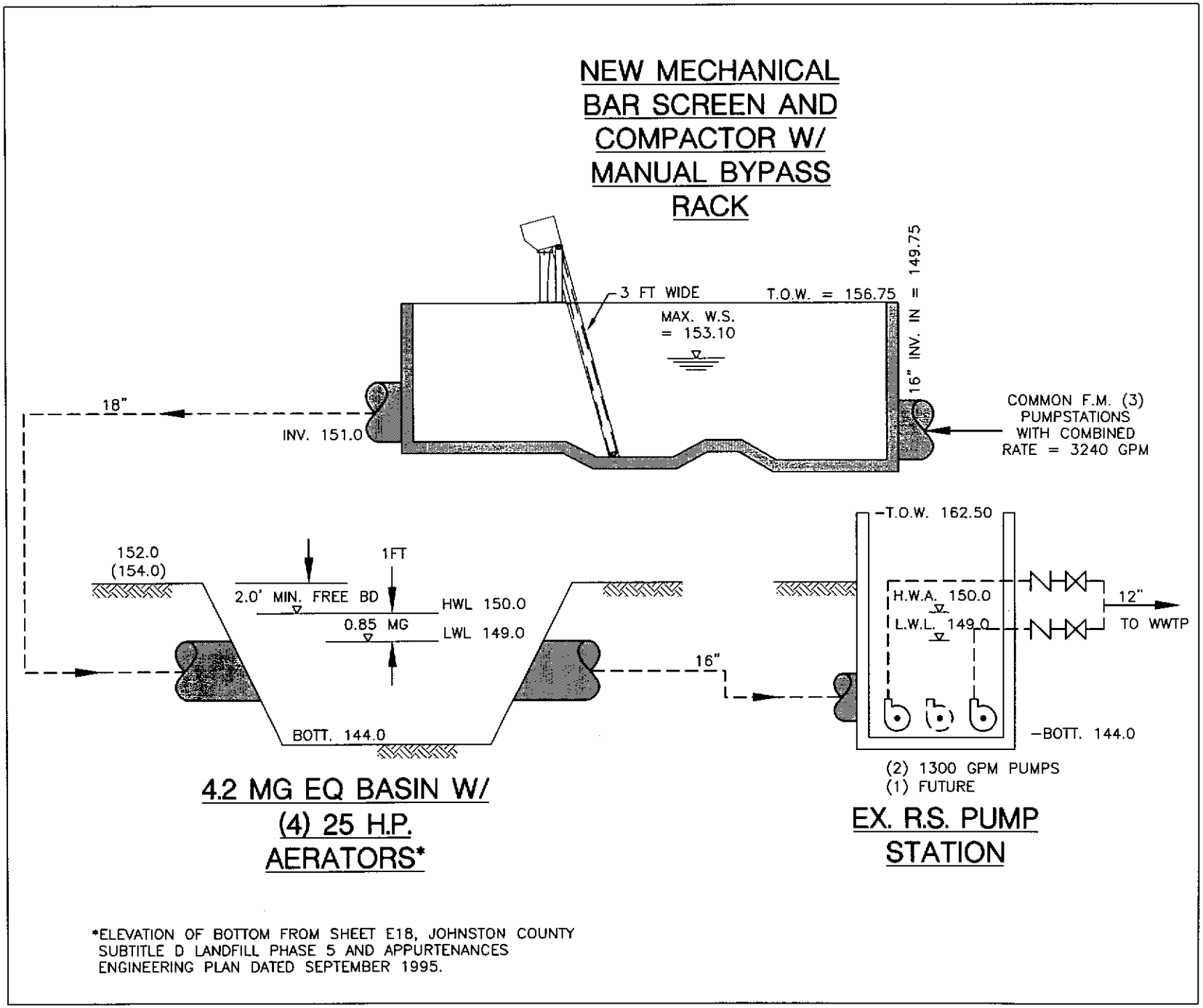
FAX: 919.881.9923

DATE	SCALE	TITLE	FIGURE NO.
09-29-06	SCALE: N.T.S.	FLOW SCHEMATICS	4-1
PROJ. NO. 50000728	PROJECT JOHNSTON COUNTY EQUALIZATION STUDY		



*ELEVATION OF BOTTOM FROM SHEET E18, JOHNSTON COUNTY SUBTITLE D LANDFILL PHASE 5 AND APPURTENANCES ENGINEERING PLAN DATED SEPTEMBER 1995.

Dewberry

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DATE 09-29-06

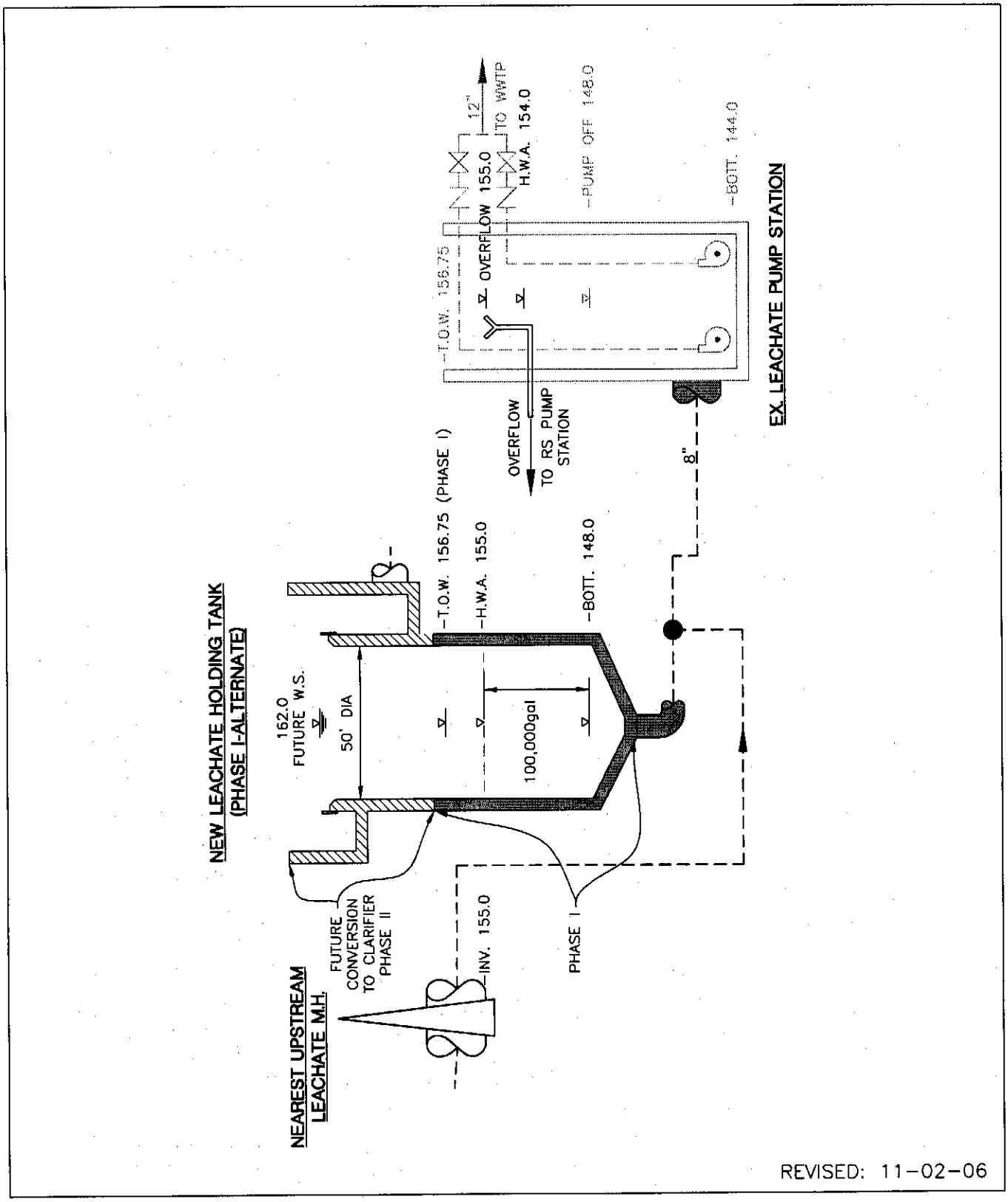
PROJ. NO. 50000728

TITLE PHASE I IMPROVEMENTS SCREENING & EQ BASIN

PROJECT JOHNSTON COUNTY

FIGURE NO. 4-2

SCALE: N.T.S.



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DATE	TITLE	FIGURE NO.
09-29-06	NEW LEACHATE HOLDING TANK	4-3
PROJ. NO.	PROJECT	
50000728	JOHNSTON COUNTY	SCALE: N.T.S.

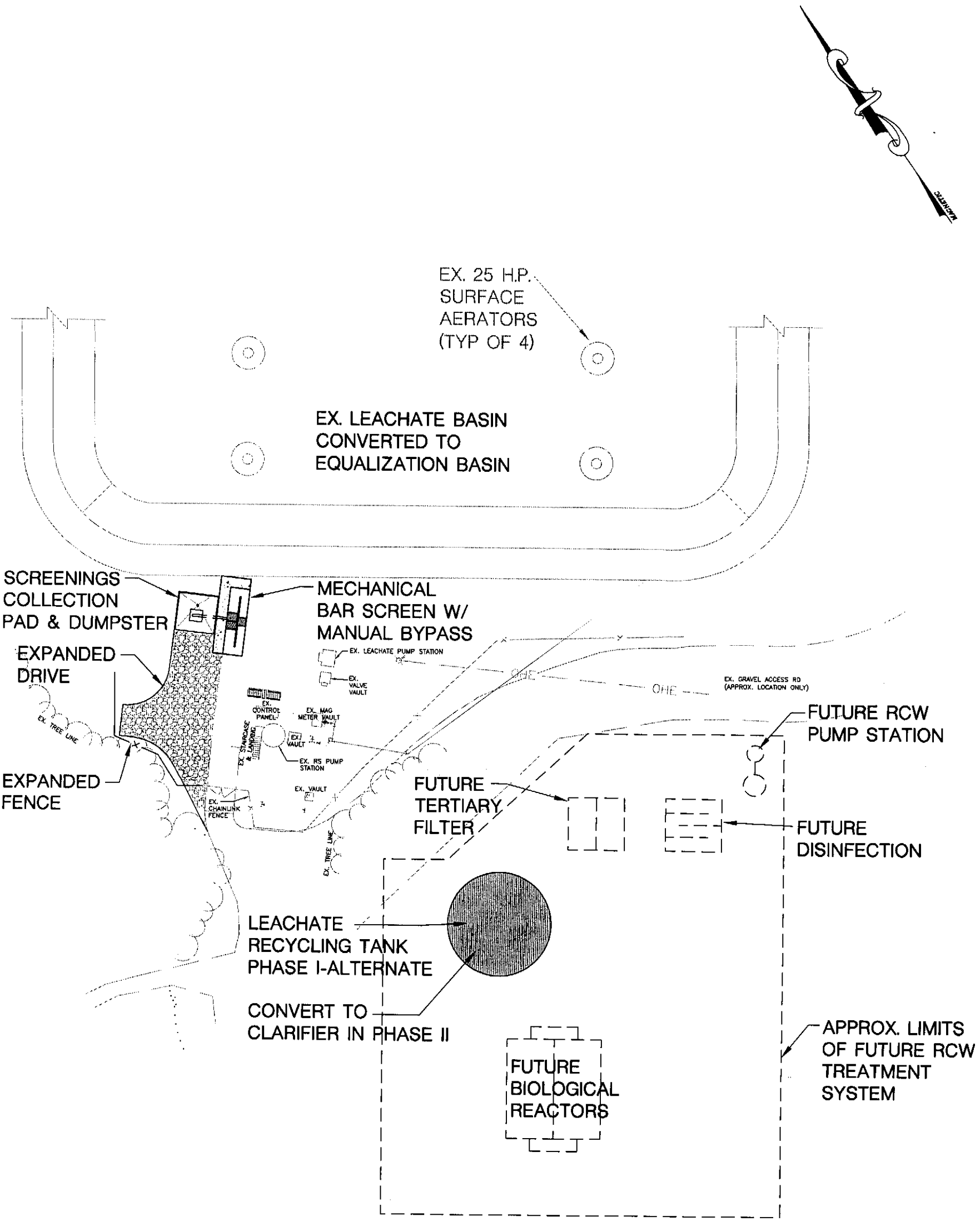

FIGURE 4-4
PRELIMINARY SITE PLAN
CONVERT 4.2 MG BASIN
TO EQUALIZATION & NEW
LEACHATE TANK

REVISED: 11-02-06

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DATE	SCALE	TITLE	FIGURE NO.
09-29-06	APPROX. 1"=50'	OVERALL SITE PLAN AND RCW TREATMENT SYSTEM	4-4
PROJ. NO. 50000728	PROJECT JOHNSTON COUNTY EQUALIZATION STUDY		

EX. 25 H.P. SURFACE AERATORS (TYP OF 4)

NOTE: TOPOGRAPHIC DATA GENERATED FROM LIDAR OBTAINED FROM THE NORTH CAROLINA FLOOD MAPPING PROGRAM.

EX. LEACHATE BASIN CONVERTED TO EQUALIZATION BASIN

18" R.S.

MECHANICAL BAR SCREEN W/ MANUAL BYPASS

SCREENINGS COLLECTION PAD

EXPANDED DRIVE

EXPANDED FENCE

REPLACE GENERATOR

18"

16"

EX. 8" DI GRAVITY LINE

N.O.

NEW 8" BYPASS LEACHATE

OVERFLOW

N.C. FOR LEACHATE RECIRCULATION

EX. LEACHATE PUMP STATION

16"

12"x16" RED.

EX. VALVE VAULT

NEW 8" LEACHATE

EX. CONTROL PANEL

EX. MAG METER VAULT

12"

EX. STAIRCASE & LANDING

EX. VAULT

EX. RS PUMP STATION

N.C.

12" DIP

EX. VAULT

6" DIP

EX. CHAINLINK FENCE

N.O.

N.O.

EX. 12" VALVE

EX. 6" VALVE

EX. 12" RS

EX. 6" RS

N.C. FOR LEACHATE RECIRCULATOIN

EX. 12" RS FM

N.C. FOR LEACHATE RECIRCULATION

EX. 8" HDPE LEACHATE GRAVITY (APPROX. LOCATION ONLY)

8"

FM

N.O.

OHE

EX. GRAVEL ACCESS RD (APPROX. LOCATION ONLY)

N.O.

PHASE I-ALTERNATE

EX. 4" RCW MAIN

EX. 12" RS FORCE MAIN

EX. 3" LEACHATE RECIRCULATION FORCE MAIN

8" LEACHATE (BIDIRECTIONAL FLOW) PHASE I-ALTERNATE

LEACHATE RECYCLING TANK PHASE I-ALTERNATE

CONVERT TO CLARIFIER IN PHASE II

SS

150

152

148

FIGURE 4-5
PRELIMINARY SITE PIPING PLAN
CONVERT 4.2 MG BASIN
TO EQUALIZATION
& NEW LEACHATE TANK

REVISED: 11-21-06

FIGURE NO. 4-5

TITLE
RCW PROPOSED SITE PIPING PLAN

SCALE APPROX. 1"=30'

PROJECT
JOHNSTON COUNTY EQUALIZATION STUDY

DATE 09-29-06

PROJ. NO. 50000728

Dewberry
Dewberry & Davis, Inc.
2301 REXWOODS DRIVE SUITE 200
RALEIGH, NC 27607
PHONE: 919.881.0650
FAX: 919.881.0623

5. COST

A project cost estimate for Phase I related work is indicated in Table 5-1 and for Phase I – Alternate related work is shown in Table 5-2.

The opinion of probable cost for the construction of this project is slightly less than the opinion of probable cost presented in the County's engineering report for the construction of a new separate equalization basin for wastewater. One difference in the cost opinions is the screening facilities. Another difference is the replacement of the generator set. The fundamental difference in the two designs should be the difference in the cost of the 1.5 MG wastewater equalization basin and the 50,000 gallon leachate tank.

Operational costs are not expected to change from current operations. Screenings will be disposed of locally and power requirements related to pumping and operation of the aerators will remain the same.

TABLE 5 - 1
Project Cost Estimate
Phase I
Equalization Basin

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Screening Structure	1	LS	$ 25,000	$ 25,000
2	Mechanical Screen and Compactor*	1	LS	$ 200,000	$ 200,000
3	Loading Pad & Sump Pump	1	LS	$ 24,500	$ 24,500
4	Compacted Fill, Misc. Site Grading, E&S, etc.	1	LS	$ 20,000	$ 20,000
5	Expanded Drive and Turn Around	1	LS	$ 12,000	$ 12,000
6	Plant Piping	1	LS	$ 45,000	$ 45,000
7	Fittings	1	LS	$ 2,100	$ 2,100
8	16" Gate Valve	1	EA	$ 6,240	$ 6,240
9	12" Gate Valve	1	EA	$ 2,730	$ 2,730
10	8" Gate Valve	3	EA	$ 1,300	$ 3,900
11	Manholes	5	EA	$ 3,500	$ 17,500
12	Pipe Penetrations/Connections (EQ Basin, Misc. Structures, Piping, Etc.)	4	EA	$ 5,000	$ 20,000
13	General Electrical & Instrumentation	1	LS	$ 30,000	$ 30,000
14	New Generator and Replace ATS	1	EA	$ 60,000	$ 60,000
15	Modification to EQ Basin Aerator Controls	1	LS	$ 10,000	$ 10,000
16	New Level, Meter, & Modify RS Pump Control System	1	LS	$ 15,000	$ 15,000
17	Mobilization (3%)	1	LS	$ 23,000	$ 23,000

** Cost includes concrete structure and screening facilities for 5.31 MGD flow*

Sub-Total	$	516,970
10% Construction Contingency	$	51,697
TOTAL CONSTRUCTION	$	568,667
Engineering and Inspection @ 15%	$	85,300
Total Project Cost	$	653,967

TABLE 5 - 2
Project Cost Estimate
Phase I - Alternate
Leachate Tank

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Screening Structure	1	LS	$ 25,000	$ 25,000
2	Mechanical Screen and Compactor*	1	LS	$ 200,000	$ 200,000
3	Loading Pad & Sump Pump	1	LS	$ 24,500	$ 24,500
4	Compacted Fill, Misc. Site Grading, E&S, etc.	1	LS	$ 20,000	$ 20,000
5	Expanded Drive and Turn Around	1	LS	$ 12,000	$ 12,000
6	Plant Piping	1	LS	$ 45,000	$ 45,000
7	Fittings	1	LS	$ 2,100	$ 2,100
8	16" Gate Valve	1	EA	$ 6,240	$ 6,240
9	12" Gate Valve	1	EA	$ 2,730	$ 2,730
10	8" Gate Valve	3	EA	$ 1,300	$ 3,900
11	Manholes	5	EA	$ 3,500	$ 17,500
12	Pipe Penetrations/Connections (EQ Basin, Misc. Structures, Piping, Etc.)	4	EA	$ 5,000	$ 20,000
13	General Electrical & Instrumentation	1	LS	$ 30,000	$ 30,000
14	New Generator and Replace ATS	1	EA	$ 60,000	$ 60,000
15	Modification to EQ Basin Aerator Controls	1	LS	$ 10,000	$ 10,000
16	New Level, Meter, & Modify RS Pump Control System	1	LS	$ 15,000	$ 15,000
17	Mobilization (3%)	1	LS	$ 23,000	$ 23,000
18	Lechate Tank	1	LS	$ 140,000	$ 140,000
19	Plant Piping for Leachate Tank	1	LS	$ 5,000	$ 5,000
20	Fittings for Leachate Tank	1	LS	$ 500	$ 500

** Cost includes concrete structure and screening facilities for 5.31 MGD flow*

Sub-Total	$ 662,470
10% Construction Contingency	$ 66,247
TOTAL CONSTRUCTION	$ 728,717
Engineering and Inspection @ 15%	$ 109,308
Total Project Cost	$ 838,025

6. CONCLUSIONS/RECOMMENDATIONS

6.1 Conclusions

- The existing leachate basin can be converted to a raw wastewater equalization basin with leachate storage with relatively minor modifications.
- A new leachate storage tank can be constructed that will not impact current operations of the existing leachate recycle system.
- The proposed new leachate holding tank can efficiently be converted to a new clarifier if the County elects to proceed in the future with constructing a treatment system for production of reclaim water.
- Proposed piping modifications are relatively simple and will provide maximum flexibility in operation of both the leachate recirculation system and the RS pump station.
- Do not replace existing aerators with soft starts. The costs associated with soft starts exceed savings of using a larger generator. If the aerators are not to be operated by the generator, the existing generator should operated one 150 HP pump.

6.2 Recommendations

Dewberry recommends that the contents of this report be carefully reviewed by Johnston County and continued coordination with G.N. Richardson & Associates be implemented in upcoming permitting negotiation with NC Division of Solid Waste Management.

7. REFERENCES

1. Barlaz, Morton A. and Robert K. Ham, General Practice for Waste Disposal, Chapman & Hill, 1993, p. 113-136
2. Summary of Six Independent Studies for 83 MSW Landfills form July 1998 USEPA Background Document, "Summary of Data on Municipal Solid Waste Landfill Leachate Characteristics."

Johnston County Leachate Pump Station Run Times, 2004 and 2005

Johnston County Leachate Laboratory Analysis, Collection Date May 10, 2005

Johnston County Subtitle D Landfill Phase 5 and Appurtenances Engineering Drawings, prepared by McKim and Creed, sealed October 9, 1996

Johnston County Wastewater Collection and treatment facilities Improvements Engineering Report prepared by Hazen and Sawyer, dated November 2005, revised January 2006

Johnston County McGees and Cleveland Area Transmission Facilities, As-built Drawings, dated February 25, 2003

APPENDIX A

Leachate Flow and Characteristics

JOHNSTON COUNTY PUBLIC UTILITIES

FAX

DATE: 11-07-05

TO: Amanda Bader FROM: L Phthisic

COMPANY: Dewberry PAGES: 5

FAX: 881-7923

RE: _____

___ URGENT ___ FOR REVIEW ___ PLEASE COMMENT

___ PLEASE REPLY ___ HARD COPY IN MAIL

COMMENTS:

If you have any difficulties reading or receiving this fax, please contact us at:
TEL: (919) 209-8333 FAX: (919) 934-7174

2004	Pump 1 Time	# of Gallons	Pump 2 Time	# of Gallons	Total Gallons to Dry well
January	0.00	0	0	0	0.00
February	19.22	230,640	0	0	230,640.00
March	0.00	0	0	0	0.00
April	6.86	82,320	0	0	82,320.00
May	5.13	61,560	0	0	61,560.00
June	4.95	59,400	0	0	59,400.00
July	12.16	145,920	0	0	145,920.00
August	20.34	244,080	0	0	244,080.00
September	47.36	354,495	0	0	354,495.00
October	8.93	53,580	0	0	53,580.00
November	4.15	24,900	0	0	24,900.00
December	0.00	0	0	0	0.00
Total: 2004 Year	129.10	1,256,895	0.00	0	1,256,895.00

2005	Pump 1 Time	# of Gallons	Pump 2 Time	# of Gallons	Total Gallons to Dry well
January	50.90	302,346	0	0	302,346.00
February	89.28	530,323	0	0	530,323.20
March	78.95	468,963	0	0	468,963.00
April	80.66	479,120	0	0	479,120.40
May	0.00	0	0	0	0.00
June	0.00	0	0	0	0.00
July	88.21	423,408	0	0	423,408.00
August	136.75	656,400	0	0	656,400.00
September	34.43	165,264	0	0	165,264.00
October	4.80	23,040	0	0	23,040.00
November		0	0	0	0.00
December		0	0	0	0.00
Total: 2005 Year	563.98	3,046,865	0.00	0	3,046,864.60

Fax from : 9199347174

Environment 1, Incorporated

P.O. BOX 7065, 114 OAKMONT DRIVE
GREENVILLE, N.C. 27835-7065

PHONE (252) 758-0208
FAX (252) 758-0038

Drinking Water ID: 37715
Wastewater ID: 10

ID#: 6033 X

JOHNSTON CO. LANDFILL (PHASE 5)
MR. KEVIN SHIELDS
P.O. BOX 2263
SMITHFIELD ,NC 27577

DATE COLLECTED: 05/10/05
DATE REPORTED : 06/09/05

REVIEWED BY:

PARAMETERS	Leachate	Analysis Date	Analyst	Method Code
Antimony, mg/l	<0.030	05/27/05	CMF	EPA200.8
Arsenic, mg/l	<0.010	05/27/05	CMF	EPA200.8
Barium, mg/l	<0.500	05/27/05	CMF	EPA200.8
Beryllium, mg/l	<0.002	05/27/05	CMF	EPA200.8
Cadmium, mg/l	<0.001	05/27/05	CMF	EPA200.8
Cobalt, mg/l	<0.010	05/27/05	CMF	EPA200.8
Copper, mg/l	<0.200	05/27/05	CMF	EPA200.8
Total Chromium, mg/l	<0.010	05/27/05	CMF	EPA200.8
Lead, mg/l	<0.010	05/27/05	CMF	EPA200.8
Nickel, mg/l	<0.050	05/27/05	CMF	EPA200.8
Selenium, mg/l	<0.020	05/27/05	CMF	EPA200.8
Silver, mg/l	<0.010	05/27/05	CMF	EPA200.8
Thallium, mg/l	<0.010	05/27/05	CMF	EPA200.8
Vanadium, mg/l	<0.040	05/27/05	CMF	EPA200.8
Zinc, mg/l	0.629	05/27/05	CMF	EPA200.8

Environment 1, Incorporated

P.O. BOX 7085, 114 OAKMONT DRIVE
GREENVILLE, N.C. 27835-7085

PHONE (252) 756-6208
FAX (252) 756-0858

Drinking Water ID: 37715
Wastewater ID: 10

ID#: 6033 A

JOHNSTON CO. LANDFILL (PHASE 5)
MR. KEVIN SHIELDS
P.O. BOX 2263
SMITHFIELD ,NC 27577

DATE COLLECTED: 05/10/05
DATE REPORTED : 05/20/05

REVIEWED BY:

PARAMETERS	Leachate	Analysis Date	Analyst	Method Code
BOD, mg/l	64	05/11/05	TRB	SM5210B
COD, mg/l	294	05/13/05	TRB	HACH8000
Total Suspended Residue, mg/l	514	05/11/05	JKD	SM2540D
Ammonia Nitrogen, mg/l	11.30	05/12/05	TWA	EPA350.1
Nitrate Nitrogen, mg/l	<0.04	05/13/05	TWA	EPA353.2
Total Phosphorus, mg/l	0.42	05/17/05	TWA	EPA365.4
Sulfate, mg/l	33.4	05/16/05	TRB	EPA375.4

Environment 1, Incorporated

P.O. BOX 7085, 114 OAKMONT DRIVE
GREENVILLE, N.C. 27835-7085

PHONE (252) 756-5208
FAX (252) 756-0832

CLIENT: JOHNSTON CO. LANDFILL (PHASE 5)
MR. KEVIN SHIELDS
P.O. BOX 2263
SMITHFIELD, NC 27577

CLIENT ID: 6033 A

ANALYST: MAO
DATE COLLECTED: 05/10/05 Page: 1
DATE ANALYZED: 05/19/05
DATE REPORTED: 05/20/05

REVIEWED BY:

VOLATILE ORGANICS
EPA METHOD 8260B

PARAMETERS, ug/l	Leachate
1. Chloromethane	<10.00
2. Vinyl Chloride	<10.00
3. Bromomethane	<10.00
4. Chloroethane	<10.00
5. Trichlorofluoromethane	<5.00
6. 1,1-Dichloroethene	<5.00
7. Acetone	<100.00
8. Iodomethane	<10.00
9. Carbon Disulfide	<100.00
10. Methylene Chloride	<10.00
11. trans-1,2-Dichloroethene	<5.00
12. 1,1-Dichloroethane	<5.00
13. Vinyl Acetate	<50.00
14. Cis-1,2-Dichloroethene	<5.00
15. 2-Butanone	<100.00
16. Bromochloromethane	<5.00
17. Chloroform	<5.00
18. 1,1,1-Trichloroethane	<5.00
19. Carbon Tetrachloride	<10.00
20. Benzene	<5.00
21. 1,2-Dichloroethane	<5.00
22. Trichloroethene	<5.00
23. 1,2-Dichloropropane	<5.00
24. Bromodichloromethane	<5.00
25. Cis-1,3-Dichloropropane	<10.00
26. 4-Methyl-2-Pentanone	<100.00
27. Toluene	<5.00
28. trans-1,3-Dichloropropene	<10.00
29. 1,1,2-Trichloroethane	<5.00
30. Tetrachloroethene	<5.00
31. 2-Hexanone	<50.00
32. Dibromochloromethane	<5.00
33. 1,2-Dibromoethane	<5.00
34. Chlorobenzene	<5.00
35. 1,1,1,2-Tetrachloroethane	<5.00
36. Ethylbenzene	<5.00
37. Xylenes	<5.00
38. Dibromomethane	<10.00
39. Styrene	<10.00
40. Bromoform	<5.00
41. 1,1,2,2-Tetrachloroethane	<5.00
42. 1,2,3-Trichloropropane	<15.00
43. 1,4-Dichlorobenzene	<5.00
44. 1,2-Dichlorobenzene	<5.00
45. 1,2-Dibromo-3-Chloropropane	<25.00
46. Acrylonitrile	<200.00
47. trans-1,4-Dichloro-2-Butene	<100.00

APPENDIX B

Process Calculations

Dewberry

Calculation Sheet

Designer RBC Date 8/16/06 Checker _____ Date _____
Title Johnston Co. CQ SJY Job No. _____
Subject CLARIFIER / Leachate Holding TK. Sheet No. 1 of _____

Clarifier Size for future 1.0 Act. Sludge WWTP

Use 400 gpd/SF @ ADF | Pomeroy criteria
1000 gpd/SF @ PHF w/o equalization
⇒ *use 800 gpd/SF for peak flow condition

Assume flow equalization ⇒ use 1.5 peak flow
⇒ 1.0 × 1.5 = 1.5 MGD

⇒ @ ADF : SURFACE AREA = $\frac{1,500,000}{800}$ = 1,875 SF
= 48.9' DIA
SAY 50' DIA
= 1963 SF

VOL. = 1963 × 14' SWD × 7.48 gal/FT³ = 206,000 gal
>> 50,000 gal

∴ Use two (2) clarifiers

⇒ 1875 SF/2 = 938 SF each = 35' DIA. EACH
= 962 SF

VOL. = 962 × 14' SWD × 7.48/gal/FT³ = 100,000 gal.

Construct in two (2) phases ; BOTT. during Phase I improvements and top with remainder of side wall and effluent flume and launders.

Set BOTT = Pump OFF level in Ex. leachate P.S
⇒ W.S @ 14' SWD = 162.0
⇒ VOL @ HWL (Phase I) = 155 = 50,300 GAL
⇒ TOW Phase I = TOW Ex. leachate P.S = 156.75

Dewberry

Calculation Sheet

Designer _____ Date _____ Checker _____ Date _____

Title _____ Job No. _____

Subject _____ Sheet No. 2 of _____

EQ Basin

Based on est. dimensions & 5' water depth = 4.0 MG

⇒ Top 1Ft level ≈ 850,000 gal.

Conclusion ⇒ Since future inflow = 1.0 & only 30% ADF req'd for full equalization ⇒ assume use of only top 1Ft for equalization.

⇒ % ADF = $\frac{850,000}{1,000,000} \times 100 = 85\% >> 30\%$

⇒ O.K.

Aeration / Mixing

EXISTING ; (4) 25 H.P Aerators

PROPOSED ;

Mixing Req'd @ TSS > 45 mg/l ≥ 0.02 HP/1,000 gal

⇒ @ 4.0 MG ⇒ MIXING = 80 H.P

∴ Exist. Aerators = 100 H.P.

⇒ O.K VV

Aeration Requirements ;

HRT = Θ_c = 4 days @ design

= $\frac{4.0 \text{ MG}}{0.30 \text{ MG}}$ = 12 days @ startup

Dewberry

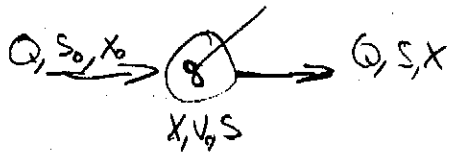
Calculation Sheet

Designer Doug H. / BSCT Date _____ Checker _____ Date _____

Title _____ Job No. _____

Subject Steady State Conc. BOD_5 Complete Mix NO Recycle Sheet No. 3 of _____

$\theta_1 = 15$ days



S = conc of substrate
Vr = reactor volume
μ_m = max specific growth rate

$$\frac{Q}{V_r} = \frac{1}{\theta} = \frac{\mu_m S}{K_s + S} - k_d$$

Complete mix reactor w/out recycle
$k = 5\ d^{-1}$
$K_s = 100\ mg/L$
$S_o = 220\ mg/L$ BOD_5 med. str. WW
$Y = 0.5$
$k_d = 0.05\ d^{-1}$
$X_o = 0$ (can be neglected)

Steady State

$$(S_o - S) - \theta\left(\frac{kXS}{K_s + S}\right) = 0$$

$$X = \frac{Y(S_o - S)}{(1 + k_d\theta)}$$

$$S = \frac{K_s(1 + \theta k_d)}{\theta(Yk - k_d) - 1}$$

$S_1 = 4.9\ mg/L$ BOD_5

$X_1 = 61.4\ mg/L$ cell conc.

} ⟸ @ 0.25 - 0.3 MGD, HRT = 15 days

CURRENT FLOW

$\theta_2 = 4$ days Q: 1 MGD, V = 4 MG

⟸ @ 1 MGD, HRT = 4 days

FUTURE

$S_2 = 13.6\ mg/L$ BOD_5

$X_2 = 86\ mg/L$ cell conc.

Dewberry

Calculation Sheet

Designer _____ Date _____ Checker _____ Date _____
Title _____ Job No. _____
Subject _____ Sheet No. 4 of _____

Chkr. H.P Required for O_2 Demand

Based on above ⇒ greatest mass removal is @ 1.0 MGD

Assume • Surface Aerators @ 2.4 lbs O_2 - HR - HP
• O_2 Req'd = 1.2 * BOD removed

BOD Removed = (220 - 13.6)(8.34)(1.0 MGD) = 1721 lbs/d

O_2 Req'd for BOD = $\frac{1.2 * 1721}{24\ HR/D}$ = 86 lbs / HR

O_2 Req'd For TKN reduction ⇒ assume [40 mg/l, 50% Red.]
⇒ $\frac{[0.5\ (40) * 8.34 * 1.0\ MGD]}{24\ hrs/d} * \frac{4.7\ O_2}{NH_4}$ = 33 lbs/hr

TOTAL O_2 Req'd = 86 + 33 = 119 lbs/HR
HP Req'd = 119/2.4 = 50 H.P << 100 ⇒ O.K ✓

Conclusion; Existing Aerators = 4 x 25 HP
= 100 HP > 80 H.P

∴ Existing aerators will work w/ no modifications and provide for approx. 50 H.P Reserve to meet additional BOD loading associated with potential future leachate addition.

APPENDIX C

Generator Sizing Calculations

CATERPILLAR — Project Sizing Report

Modified Date	9/29/2006	Electricity Supply	60 Hz 480/277 V
Customer Name	Johnson County	Connection	***
Project Name/Ref #	50000728-Flow Equalization...	Max Ambient Temperature	110.0 F
Prepared By	Gary Wood	Altitude	500.0 ft A.S.L.

Max Transient Load Step	297.5 skVA	118.2 skW	
Peak Transient Load	297.5 skVA	118.2 skW	
Final Running Load	132.2 kVA	119.0 kW	0.90 PF
Max Running Non Linear Load	0.0 RkVA		
Maximum Running Load	132.2 kVA	119.0 kW	

Genset Model	(1) of D200P3	Nameplate Rating	200.0 kW
Feature Code	***		250.0 kVA
Fuel	Diesel		0.8 PF
Rating Type	Standby	Site Output	196.0 kW
Length	***		245.0 kVA
Width	***	Max Transient Voltage Dip	30.0%
Height	***	Dry Weight	***

Make/Model	1306-E87TA300	Emissions/Certifications	Not Certified
Aspiration	***	Governor	ELEC
Cylinder Configuration	***	Aftercooler Type	ATAAC
Displacement	***	Rejection To Jacket Water	***
Speed	RPM	Rejection To Aftercooler	***
Fuel Rate	***	Rejection To Oil Cooler	***
Exhaust Sound Level	***	Rejection To Atmosphere	***
Mechanical Sound Level	***	Rejection To Exhaust	***
Max Combustion Inlet Air Temp	***	Exhaust Recoverable	***
Combustion Airflow	***	Exhaust Stack Temperature	***
Cooling System Ambient Capability	***	Exhaust Flow Rate	***
Cooling System Airflow *	***	Exhaust Flange Size	***
Engine Performance Number	***		

Alternator Arrangement Number	***	Insulation	***
Alternator Type	Olympian	Temperature Rise	***
Alternator Frame Size	LL5014F	Rejection To Atmosphere	***
Alternator Winding Pitch	***	Peak Amps	***
Number Of Poles	***	Rated Amps	***
Excitation	SE	Short Circuit Ratio	***
Winding Type	RANDOM WOUND		

Reactances		per unit	ohms	Instantaneous Voltage Dip **	skVA Capability
Subtransient - Direct Axis	X"d	***	***	10%	***
Subtransient - Quadrature Axis	X"q	***	***	20%	***
Transient - Saturated	X'd	***	***	30%	***
Synchronous - Direct Axis	Xd	***	***	35%	***
Synchronous - Quadrature Axis	Xq	***	***		
Negative Sequence	X2	***	***		
Zero Sequence	X0	***	***		

Generator Time Constants		sec
Open Circuit Transient - Direct Axis	T'd0	***
Short Circuit Transient - Quadrature Axis	T'd	***
Open Circuit Subtransient - Direct Axis	T"d0	***
Short Circuit Subtransient - Direct Axis	T"d	***
Open Circuit Subtransient - Quadrature...	T"q0	***
Short Circuit Subtransient - Quadratur...	T"q	***
Armature Short Circuit	TA	***

Notes:
* Based on 1/2 inch water (0.12 kPa) external restriction and 1000 ft (300m) altitude.
** Based on instantaneous voltage dip as defined per NEMA MG-1.
*** See your Caterpillar dealer and/or Spec Sheet for technical information.
Maximum voltage distortion due to non-linear load calculated to be within specified limits.
Overall dimensions and weight not to be used for installation. Contact your Caterpillar dealer for specific dimension drawings.
Caterpillar makes no express warranties and disclaims all implied warranties, including merchantability and fitness for a particular purpose, regarding program. Caterpillar shall have no liability in law or equity, for damages, consequential or otherwise, arising from use of program and related material or any part thereof.

CATERPILLAR | **Project Sizing Report**

Modified Date	9/22/2006	Electricity Supply	60 Hz 480/277 V
Customer Name	Johnson County	Connection	STAR
Project Name/Ref #	50000728-Flow Equalization...	Max Ambient Temperature	110.0 F
Prepared By	Gary Wood	Altitude	500.0 ft A.S.L.

Load Summary

Max Transient Load Step	297.5 skVA	118.2 skW	
Peak Transient Load	297.5 skVA	233.0 skW	
Final Running Load	259.3 kVA	227.0 kW	0.88 PF
Max Running Non Linear Load	0.0 RkVA		
Maximum Running Load	259.3 kVA	227.0 kW	

25 HP motors with soft starts

Genset

Genset Model	(1) of C9 DITA	Nameplate Rating	250.0 kW
Feature Code	C09DE02		312.5 kVA
Fuel	Diesel		0.8 PF
Rating Type	Standby	Site Output	250.0 kW
Length	123.3 in		312.5 kVA
Width	43.8 in	Max Transient Voltage Dip	30.0%
Height	72.6 in	Dry Weight	4,900.0 lbs

Engine

Make/Model	C9 DITA	Emissions/Certifications	EPA TIER 3
Aspiration	TA	Governor	ELEC
Cylinder Configuration	INLINE - 6	Aftercooler Type	ATAAC
Displacement	537 Cubic Inch	Rejection To Jacket Water	5,971 BTU/min
Speed	1800 RPM	Rejection To Aftercooler	4,515 BTU/min
Fuel Rate	19.4 gph	Rejection To Oil Cooler	2,224 BTU/min
Exhaust Sound Level	0 dBA at 23 ft/7 m	Rejection To Atmosphere	1,951 BTU/min
Mechanical Sound Level	0 dBA at 23 ft/7 m	Rejection To Exhaust	15,184 BTU/min
Max Combustion Inlet Air Temp	122.4 F	Exhaust Recoverable	8,189 BTU/min
Combustion Airflow	879.3 cfm	Exhaust Stack Temperature	854 F
Cooling System Ambient Capability	131.0 F	Exhaust Flow Rate	2,242 cfm
Cooling System Airflow *	17,551.4 cfm	Exhaust Flange Size	0 in
Engine Performance Number	DM8501		

Alternator Technical Data

Alternator Arrangement Number	2541292	Insulation	CLASS H
Alternator Type	LC	Temperature Rise	270 F
Alternator Frame Size	LC5014H	Rejection To Atmosphere	1,120.3 BTU/min
Alternator Winding Pitch	0.6667	Peak Amps	***
Number Of Poles	4	Rated Amps	376.5
Excitation	SE	Short Circuit Ratio	0.3800
Winding Type	RANDOM WOUND		

Reactances		per unit	ohms
Subtransient - Direct Axis	X"d	0.0980	0.0720
Subtransient - Quadrature Axis	X"q	0.1190	0.0880
Transient - Saturated	X'd	0.1610	0.1190
Synchronous - Direct Axis	Xd	3.3940	2.5020
Synchronous - Quadrature Axis	Xq	2.0360	1.5010
Negative Sequence	X2	0.1090	0.0800
Zero Sequence	X0	0.0050	0.0040

Instantaneous Voltage Dip **	skVA Capability
10%	140.65
20%	316.46
30%	542.50
35%	681.60

Generator Time Constants		sec
Open Circuit Transient - Direct Axis	T'd0	2.1050
Short Circuit Transient - Quadrature Axis	T'd	0.1000
Open Circuit Subtransient - Direct Axis	T"d0	0.0170
Short Circuit Subtransient - Direct Axis	T"d	0.0100
Open Circuit Subtransient - Quadrature...	T"q0	0.1690
Short Circuit Subtransient - Quadratur...	T"q	0.0100
Armature Short Circuit	TA	0.0150

Notes:
* Based on 1/2 inch water (0.12 kPa) external restriction and 1000 ft (300m) altitude.
** Based on instantaneous voltage dip as defined per NEMA MG-1.
*** See your Caterpillar dealer and/or Spec Sheet for technical information.
Maximum voltage distortion due to non-linear load calculated to be within specified limits.
Overall dimensions and weight not to be used for installation. Contact your Caterpillar dealer for specific dimension drawings.
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Project Load Report

Modified Date	9/22/2006	Rating Type	Standby	Max. Ambient Temp.	110 Deg. F
Customer Name	Johnson County	Fuel	Diesel	Altitude	500.0 ft A.S.L.
Project Name/Ref #	50000728-Flow Equalizati...	Electricity Supply	60 Hz 480/277 V		
Prepared By	Gary Wood				

Load Details			Instantaneous Voltage Dip			Load Analysis							
						Transient Inrush		Running		Resultant Peak		Cumulative Running	
Load Step		Load Description	Permitted Voltage Dip	Step Maximum Permitted	Selected Genset	SkVA	SkW	kVA	kW	kVA	kW	kVA	kW
1.1	1	150.00 HP Motor - NEMA											
		Pump											
		NEMA, 3-Phase Motor, Soft Starter, 225%...	30%			297.5	118.2	132.2	119.0				
		Step 1 Total		30%	19.0	297.5	118.2	132.2	119.0				
		Total Through Step 1								297.5	118.2	132.2	119.0
2.1	1	5.00 HP Motor - NEMA											
		Screen											
		NEMA, 3-Phase Motor, Across the line, Loa...	30%			33.5	19.1	5.6	4.4				
		Step 2 Total		30%	2.6	33.5	19.1	5.6	4.4				
		Total Through Step 2								162.2	138.1	137.7	123.4
3.1	1	25.00 HP Motor - NEMA											
		Aerator											
		NEMA, 3-Phase Motor, Soft Starter, 225%...	30%			54.8	26.8	24.4	20.7				
		Step 3 Total		30%	4.1	54.8	26.8	24.4	20.7				
		Total Through Step 3								185.8	150.2	162.0	144.1
4.1	1	25.00 HP Motor - NEMA											
		Aerator											
		NEMA, 3-Phase Motor, Soft Starter, 225%...	30%			54.8	26.8	24.4	20.7				
		Step 4 Total		30%	4.1	54.8	26.8	24.4	20.7				
		Total Through Step 4								209.9	170.9	186.3	164.9
5.1	1	25.00 HP Motor - NEMA											
		Aerator											
		NEMA, 3-Phase Motor, Soft Starter, 225%...	30%			54.8	26.8	24.4	20.7				
		Step 5 Total		30%	4.1	54.8	26.8	24.4	20.7				
		Total Through Step 5								234.2	191.6	210.6	185.6
6.1	1	25.00 HP Motor - NEMA											
		Aerator											
		NEMA, 3-Phase Motor, Soft Starter, 225%...	30%			54.8	26.8	24.4	20.7				
		Step 6 Total		30%	4.1	54.8	26.8	24.4	20.7				
		Total Through Step 6								258.5	212.3	234.9	206.3
7.1	1	25.00 HP Motor - NEMA											
		Aerator											
		NEMA, 3-Phase Motor, Soft Starter, 225%...	30%			54.8	26.8	24.4	20.7				
		Step 7 Total		30%	4.1	54.8	26.8	24.4	20.7				
		Total Through Step 7								282.9	233.0	259.3	227.0

CATERPILLAR® Project Sizing Report

Modified Date	9/22/2006	Electricity Supply	60 Hz 480/277 V
Customer Name	Johnson County	Connection	STAR
Project Name/Ref #	50000728-Flow Equalization...	Max Ambient Temperature	110.0 F
Prepared By	Gary Wood	Altitude	500.0 ft A.S.L.

Load Analysis

Max Transient Load Step	297.5 skVA	118.2 skW		25 HP across the line
Peak Transient Load	350.9 skVA	263.2 skW		
Final Running Load	259.3 kVA	227.0 kW	0.88 PF	
Max Running Non Linear Load	0.0 RkVA			
Maximum Running Load	259.3 kVA	227.0 kW		

Genset

Genset Model	(1) of C9 DITA	Nameplate Rating	300.0 kW / 375.0 kVA / 0.8 PF
Feature Code	C09DE03		
Fuel	Diesel		
Rating Type	Standby	Site Output	300.0 kW / 375.0 kVA
Length	123.3 in		
Width	43.8 in	Max Transient Voltage Dip	30.0%
Height	72.6 in	Dry Weight	5,042.0 lbs

Engine Performance Data

Make/Model	C9 DITA	Emissions/Certifications	EPA TIER 3
Aspiration	TA	Governor	ELEC
Cylinder Configuration	INLINE - 6	Aftercooler Type	ATAAC
Displacement	537 Cubic Inch	Rejection To Jacket Water	6,881 BTU/min
Speed	1800 RPM	Rejection To Aftercooler	5,056 BTU/min
Fuel Rate	22.7 gph	Rejection To Oil Cooler	2,616 BTU/min
Exhaust Sound Level	0 dBA at 23 ft/7 m	Rejection To Atmosphere	2,457 BTU/min
Mechanical Sound Level	0 dBA at 23 ft/7 m	Rejection To Exhaust	17,573 BTU/min
Max Combustion Inlet Air Temp	122.7 F	Exhaust Recoverable	9,895 BTU/min
Combustion Airflow	907.6 cfm	Exhaust Stack Temperature	931 F
Cooling System Ambient Capability	120.2 F	Exhaust Flow Rate	2,461 cfm
Cooling System Airflow *	17,551.4 cfm	Exhaust Flange Size	0 in
Engine Performance Number	DM8168		

Alternator Data

Alternator Arrangement Number	2377184	Insulation	CLASS H
Alternator Type	LC	Temperature Rise	270 F
Alternator Frame Size	LC5014J	Rejection To Atmosphere	1,245.4 BTU/min
Alternator Winding Pitch	0.6667	Peak Amps	***
Number Of Poles	4	Rated Amps	451.1
Excitation	SE	Short Circuit Ratio	0.4200
Winding Type	RANDOM WOUND		

Reactances		per unit	ohms	Instantaneous Voltage Dip **	skVA Capability
Subtransient - Direct Axis	X"d	0.0900	0.0550	10%	176.65
Subtransient - Quadrature Axis	X"q	0.1110	0.0680	20%	397.46
Transient - Saturated	X'd	0.1510	0.0930	30%	681.35
Synchronous - Direct Axis	Xd	3.2910	2.0220	35%	856.06
Synchronous - Quadrature Axis	Xq	1.9740	1.2130		
Negative Sequence	X2	0.0990	0.0610		
Zero Sequence	X0	0.0050	0.0030		

Generator Time Constants		sec
Open Circuit Transient - Direct Axis	T'd0	2.1750
Short Circuit Transient - Quadrature Axis	T'd	0.1000
Open Circuit Subtransient - Direct Axis	T"d0	0.0170
Short Circuit Subtransient - Direct Axis	T"d	0.0100
Open Circuit Subtransient - Quadrature...	T"q0	0.1770
Short Circuit Subtransient - Quadratur...	T"q	0.0100
Armature Short Circuit	TA	0.0150

Notes:
* Based on 1/2 inch water (0.12 kPa) external restriction and 1000 ft (300m) altitude.
** Based on instantaneous voltage dip as defined per NEMA MG-1.
*** See your Caterpillar dealer and/or Spec Sheet for technical information.
Maximum voltage distortion due to non-linear load calculated to be within specified limits.
Overall dimensions and weight not to be used for installation. Contact your Caterpillar dealer for specific dimension drawings.
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Project Load Report

Modified Date	9/22/2006	Rating Type	Standby	Max. Ambient Temp.	110 Deg. F
Customer Name	Johnson County	Fuel	Diesel	Altitude	500.0 ft A.S.L.
Project Name/Ref #	50000728-Flow Equalizati...	Electricity Supply	60 Hz 480/277 V		
Prepared By	Gary Wood				

Load Details			Instantaneous Voltage Dip			Load Analysis							
Load Step		Load Description	Permitted Voltage Dip	Step Maximum Permitted	Selected Genset	Transient Inrush		Running		Resultant Peak		Cumulative Running	
						SkVA	SkW	kVA	kW	kVA	kW	kVA	kW
1.1	1	150.00 HP Motor - NEMA Pump NEMA, 3-Phase Motor, Soft Starter, 225%...	30%			297.5	118.2	132.2	119.0				
		Step 1 Total		30%	15.8	297.5	118.2	132.2	119.0				
		Total Through Step 1								297.5	118.2	132.2	119.0
2.1	1	5.00 HP Motor - NEMA Screen NEMA, 3-Phase Motor, Across the line, Loa...	30%			33.5	19.1	5.6	4.4				
		Step 2 Total		30%	2.1	33.5	19.1	5.6	4.4				
		Total Through Step 2								162.2	138.1	137.7	123.4
3.1	1	25.00 HP Motor - NEMA Aerator NEMA, 3-Phase Motor, Across the line, Loa...	30%			132.5	57.0	24.4	20.7				
		Step 3 Total		30%	7.7	132.5	57.0	24.4	20.7				
		Total Through Step 3								255.3	180.4	162.0	144.1
4.1	1	25.00 HP Motor - NEMA Aerator NEMA, 3-Phase Motor, Across the line, Loa...	30%			132.5	57.0	24.4	20.7				
		Step 4 Total		30%	7.7	132.5	57.0	24.4	20.7				
		Total Through Step 4								279.1	201.1	186.3	164.9
5.1	1	25.00 HP Motor - NEMA Aerator NEMA, 3-Phase Motor, Across the line, Loa...	30%			132.5	57.0	24.4	20.7				
		Step 5 Total		30%	7.7	132.5	57.0	24.4	20.7				
		Total Through Step 5								303.0	221.8	210.6	185.6
6.1	1	25.00 HP Motor - NEMA Aerator NEMA, 3-Phase Motor, Across the line, Loa...	30%			132.5	57.0	24.4	20.7				
		Step 6 Total		30%	7.7	132.5	57.0	24.4	20.7				
		Total Through Step 6								326.9	242.5	234.9	206.3
7.1	1	25.00 HP Motor - NEMA Aerator NEMA, 3-Phase Motor, Across the line, Loa...	30%			132.5	57.0	24.4	20.7				
		Step 7 Total		30%	7.7	132.5	57.0	24.4	20.7				
		Total Through Step 7								350.9	263.2	259.3	227.0