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Department of Energy

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Mr. James A. Saric, Remedial Project Manager
U.S. Environmental Protection Agency
Region V, SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

DOE-0159-00

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

PERMANENT LEACHATE TRANSMISSION SYSTEM - CONCEPTUAL DESIGN

Enclosed for your information is the Conceptual Design Report for the design of the enhanced Permanent Leachate Transmission System (LTS) associated with the On-Site Disposal Facility (OSDF). The highlights of this report were presented to the U.S Environmental Protection Agency (U.S. EPA) and Ohio Environmental Protection Agency (OEPA) on September 2, 1999.

The report describes the proposed LTS design including the enhancements, and contains conceptual drawings. The enhancements were developed primarily to improve the operability and maintainability of the LTS; more spacious lined concrete valve houses, rather than manholes, are proposed to contain the leachate collection and leak detection systems.

As discussed at the September 2, 1999, meeting, the OSDF Final Design Criteria Package, Final Design Calculations Package, and Final Design Drawings were reviewed to identify inconsistencies associated with the new conceptual design. The results of these reviews and the proposed modifications of these packages are documented in the report.

Fluor Daniel Fernald, Inc. and GeoSyntec Consultants have initiated detailed design and construction planning based on the conceptual design letter report.

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If you have any questions on the report, please contact Robert Janke at (513) 648-3124 or Jay Jalovec at (513) 648-3122.

Sincerely,

Johnny Reising

FEMP:Jalovec

Johnny W. Reising
Fernald Remedial Action
Project Manager

Enclosure

cc w/enclosure:
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T. Schneider, OEPA – Dayton (three copies of enclosure)
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29 October 1999

Mr. Jack Hughes
Fluor Daniel Fernald
Aquifer Restoration/Wastewater Project
7400 Wiley Road, MS 52-5
Hamilton, Ohio 45013

Subject: Letter Report
Leachate Transmission System – Conceptual Design
On-Site Disposal Facility

Dear Mr. Hughes:

INTRODUCTION

On 7 July 1999, Fluor Daniel Fernald (FDF) and GeoSyntec Consultants (GeoSyntec) met and developed a conceptual design idea to modify the leachate transmission system (LTS) for the On-Site Disposal Facility (OSDF). The modifications to the LTS are required to conform to FDF operational requirements and to bring the LTS in compliance with FDF's responses to comments received from the United States Environmental Protection Agency (USEPA) and Ohio Environmental Protection Agency (OEPA). The conceptual design idea includes:

- replacing the constructed (i.e., Cells 1, 2 and 3) and proposed (i.e., Cells 4 through 9) leak detection system (LDS) and leachate collection system (LCS) manholes, located on the east side of the access corridor, with valve houses located on the west side of the access corridor; and
- relocating the permanent LTS gravity line to the west side of the access corridor.

INFORMATION ONLY

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In accordance with the 23 July 1999 Statement of Work (SOW) for the Leachate Transmission System – Conceptual Design [Letter No. C: PS(CA/ACQ):99-1261], GeoSyntec was tasked to perform the following work.

- *Task 1A:* Compare the 7 July 1999 conceptual design idea with the requirements of the Final Design Criteria Package (DCP) [DCP, Rev. 0] for the OSDF, identify any inconsistencies for consideration by FDF and United States Department of Energy (DOE), and develop modifications to the conceptual design idea to remedy potential inconsistencies.

- *Task 1B:* Prepare a conceptual design package for submission to FDF, DOE, USEPA and OEPA.

The purpose of this letter report is to present the completed deliverables for Tasks 1A and 1B, which include:

- a summary of select DCP definitions related to the leachate management system;

- results of a comparison of the conceptual design idea to Section 2.5.3, *Leachate Transmission System*, of the DCP;

- results of a review of the OSDF Final Design Calculation Package to identify calculation results that influence the design of the LTS and may affect the geometry and location of the conceptual design;

- results of a review of the OSDF Final Design Drawings to identify spatial constraints that influence the design of the LTS and may affect the geometry and location of the conceptual design; and

- a Conceptual Design Package presenting proposed revisions to the DCP and preliminary drawings of the conceptual design.

SELECT DCP DEFINITIONS

On 2 August 1999, FDF and GeoSyntec met to develop the conceptual design idea into a conceptual design. To provide a clear understanding of the design of the OSDF LTS, the first items presented for discussion were select definitions from the DCP. A summary of the definitions is presented below.

- Major Components of the OSDF: The major components of the OSDF include: liner system, final cover system, leachate management system, surface-water management system, support elements, utilities, and temporary support facilities. Of these major components, the liner and leachate management systems were defined in further detail as described below.

  - The liner system contains the LCS, which is located above the primary liner, and the LDS, which is located above the secondary liner. Therefore by definition, the LCS and LDS are components of the liner system and terminate respectively where the LDS pipe, LCS pipe, and redundant LCS pipe penetrate the secondary and primary liners (i.e., components inside a cell).

  - The leachate management system (LMS) collects leachate generated by the OSDF and conveys it to the biosurge lagoon. Components of the LMS within the OSDF battery limit include: double-walled gravity drain pipe from each OSDF cell, leak detection and leachate collection manholes, double-walled gravity transmission pipe, permanent lift station (PLS), temporary double-walled gravity transmission pipe to convey leachate to the PLS prior to the complete construction of the permanent gravity transmission pipe, and a till monitoring system (i.e., horizontal monitoring well). The leachate transmission system (LTS) consists of all of the above components within the battery limit except the till monitoring system. Therefore by definition, the LTS begins at the locations where the LDS pipe, LCS pipe, and redundant LCS pipe penetrate the secondary and primary liners (i.e., components outside a cell) and terminates at the PLS.

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- Design Life of LMS: To describe the behavior of the OSDF over time, three primary periods of behavior have been defined in the DCP. These periods and there applicability to the LMS are summarized below.

  - *Initial Period.* The initial period is defined as the period from initial construction until the end of the 30-year post-closure monitoring period described in the Final ROD for OU2. Throughout this initial period, all components of the OSDF are maintained in a fully-functional condition.

  - *Intermediate Period.* The intermediate period is assumed to begin 30 years after final closure of the OSDF and to last for at least 200 years, and up to 1,000 years to the extent reasonably achievable. During this period, the LCS and LDS are still capable of being maintained and the LMS is capable of being fully maintained.

  - *Final Period.* The final period is defined as the period during which the performance of the OSDF has stabilized to its permanent state. The final period does not occur for at least 200 years and possibly up to 1,000 years after final closure of the OSDF. During this period, the LCS and LDS are no longer maintained.

Based on the definitions presented above, the LTS components that will be redesigned are the components of the LMS outside the liner system of each OSDF cell and extending to the PLS, less the till monitoring system.

COMPARISON OF CONCEPTUAL DESIGN IDEA TO DCP

To facilitate development of the LTS conceptual design, a comparison of the conceptual design idea to the DCP was performed. Based on the results of this comparison, a table (Attachment A) was prepared to present the results of the comparison, which include: (i) summary of the design criteria for the LTS; (ii) the origin of the criteria (e.g., ARAR, functional requirement, or design consideration); (iii) the design intent of the criteria; (iv) an identification of design criteria, based on the design intent of the criteria, that DOE, OEPA, USEPA (Agencies) or Stakeholders may

consider to be inconsistent with the conceptual design idea; and (v) an indication of the design criteria that may need to be revised.

During the 2 August 1999 meeting between FDF and GeoSyntec, discussions were held regarding the origin of the design criteria for the LTS and the design intent of the criteria. Based on the results of these discussions, FDF and GeoSyntec jointly identified the design criteria that the DOE, Agencies or Stakeholders may consider to be inconsistent with the conceptual design idea and the design criteria that may need to be revised. The results of this identification process are shown on the table presented in Attachment A.

Based on a review of the comparison results, the conceptual design idea meets the design intent of all the LTS design criteria. However, revisions to the DCP will be required to:

- replace terminology that was specific to the previous design with terminology that is specific to the conceptual design (e.g., "manhole" would be replaced with "valve house"); and
- reflect modifications in the operations of the LTS due to the configuration of conceptual design.

Proposed changes to the DCP are discussed in the Conceptual Design Package Section of this letter report.

REVIEW OF OSDF FINAL DESIGN CALCULATION PACKAGE

A review of the Final Design Calculation Package was performed to identify calculation results that influenced the design of the LTS and may affect the geometry and location of the conceptual design. Based on the results of the review, the results from four calculation packages were identified and are discussed further below.

- *Foundation Settlement [Section 5.1, Final Design Calculation Package]*: Foundation settlement of the OSDF affects the slopes of the LDS, LCS and redundant LCS pipes, which consequently affects the flow capacity of these

pipes. To prevent a decrease in the flow capacity of these pipes, due to differential settlement of the OSDF foundation, these pipes were connected to the valve houses at similar elevations as those for the LDS and LCS manholes presented in the Final Design Package.

- *Action Leakage Rate [Section 9.5, Final Design Calculation Package]*: The action leakage rate from the OSDF LDS was used to size the capacity of the primary containment vessel in the LDS manhole. The required capacity was equal to 130 gal, and was calculated by multiplying the action leakage rate (20 gal/acre-day) by the acreage of an OSDF cell (6.5 acres). Using a factor of safety of two, and sizes of readily available tanks, a 300-gal tank has been selected for use inside the valve house and is intended to replace the primary containment vessel used in the Final Design Package.

- *LCS and LDS Manhole Hydrostatic Uplift [Section 10.3.1, Final Design Package]*: The high density polyethylene (HDPE) manholes presented in the Final Design Package are subject to hydrostatic uplift pressure due to the perched zone potentiometric surface (PZPS) in the till layer below the OSDF. The PZPS is presented on Final Design Drawing X-9, and generally flows to the east. Based on a review of Section 10.3.3, the maximum elevation of the perched zone potentiometric surface above the base of the HDPE manhole at Cell 1 is 8.5 ft. The base of the valve house is approximately 1 ft higher than the base of the HDPE manhole. Therefore, the valve house will be subject to a maximum of 7.5 ft of hydrostatic uplift pressure. During preparation of the detailed design for the valve house, hydrostatic uplift will be considered and the structure will be designed to accommodate this load condition.

- *Surface-water Runon/Runoff and Drainage Control Structures, Western Area [Section 12.1, Final Design Package]*: Runoff from the western area of the OSDF is controlled by two 25-year drainage channels, one located to the east and one located to the west of the access corridor, as shown on Final Design Drawing G-21, Detail 11.

  - The purpose of the eastern drainage channel is to control runoff from the OSDF during a 25-year, 24-hour storm event, and prevent damage (i.e.,

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"washout") to the access corridor. Gravity drainage inlet structures are located in this eastern drainage channel at 200-ft intervals to convey runoff under the access corridor to the western 25-year drainage channel (see Final Design Drawing G-11). Overflow of the eastern channel will occur during greater return frequency storm events (e.g., 100-year or 2,000-year). To prevent potential flooding of the valve house by overflow from the eastern channel, an approximate 1-ft high curb has been included as part of the valve house foundation.

- The purpose of the western drainage channel is to convey runoff away from the OSDF during a 25-year, 24-hour storm event. The flow depths in this channel are largely dependent on the volume of runoff that particular channel sections receive from the eastern channel. To prevent potential flooding of the valve houses by flows in the various sections of the western channel, an evaluation will be performed, during preparation of the detailed design, to ensure that the valve house foundations are higher, by at least one foot, than the corresponding flow depths in the channel sections.

REVIEW OF OSDF FINAL DESIGN DRAWINGS

A review of the Final Design Drawings was performed to identify spatial constraints that influenced the design of the LTS and may affect the geometry and location of the conceptual design idea. Based on the results of the review, three spatial constraints were identified and are discussed further below.

- *Gravity Drainage Inlet Structure Orientation [Final Design Drawing G-31]*: The Final Design gravity drainage inlet structures are oriented to discharge runoff to the western 25-year drainage channel at a 45-degree angle to the flow line of the channel (i.e., to the southwest). The proposed location of the conceptual design idea conflicts with this orientation of the gravity drainage inlet structures. To remedy this conflict, the orientation of the structures will be redirected to discharge at a 90-degree angle to the flow line of the western channel (i.e., to the due west). This proposed orientation would not effect the surface-water management system of the OSDF.

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- *Permanent LTS Pipe Profile*: The profile of the permanent LTS pipe in the conceptual design idea will be required to start at an invert elevation equal to the as-built invert elevation of the LTS pipe stubout at the PLS. The conceptual design idea will accommodate this physical constraint while being able to maintain the minimum flow capacity requirements presented in Section 10.1.1, *LTS Gravity Line Flow Capacity*, of the Final Design Calculation Package.

- *Slope of LDS, LCS and Redundant LCS pipes at Cells 1, 2 and 3*: The LDS, LCS and redundant LCS pipes for Cells 1, 2 and 3 are existing. Consequently, the conceptual design idea will be required to accommodate the as-built elevations of these pipes. To accomplish this, the proposed valve houses were located on the west side of the access road to allow for excavation and tie-in to the existing locations of the LDS, LCS and redundant LCS pipes at Cells 1, 2 and 3.

CONCEPTUAL DESIGN PACKAGE

The Conceptual Design Package consists of two parts:

- proposed revisions to the DCP; and

- preliminary drawings of the conceptual design.

Attachment B presents the proposed revisions to the DCP with reference to the appropriate section of the DCP to be revised. The revisions were prepared based on the conceptual design and may be refined during the detailed design effort.

Attachment C presents the four preliminary drawings (Rev. B) of the conceptual design. The conceptual design includes:

- replacing the constructed (i.e., Cells 1, 2 and 3) and proposed (i.e., Cells 4 through 9) LDS and LCS manholes, located on the east side of the access corridor, with valve houses (i.e., reinforced concrete foundation and metal superstructure) located on the west side of the access corridor [Note: the valve houses at Cells 8 and 9 could possibly be located on the east side of the access

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corridor, depending on the identification of additional spatial constraints during the detailed design effort];

- relocating the permanent LTS gravity line to the west side of the access corridor [Note: the permanent LTS gravity line adjacent to Cells 8 and 9 could possibly be located on the east side of the access corridor, depending on the identification of additional spatial constraints during the detailed design effort];

- lining the interior of the valve house foundation with HDPE sheet [e.g., ACROLINE®-Concrete Protective Liner (Plastic Fusion Fabricators, Inc.) or BEKAPLAST® (Atlas Minerals & Chemicals, Inc.) to an elevation higher than the containment pipe penetrations for the LDS, LCS, redundant LCS and permanent LTS gravity line pipes and to provide a lined-interior secondary containment volume of the valve house equal to or greater than the volume of the existing manholes;

- providing access (i.e., stairs) to the valves houses to allow easier operation and maintenance;

- providing additional valves upstream of the PLS to improve operational control of the LTS [Note: the specific location of the valves will be determined during the detailed design effort];

- providing a means in each valve house to monitor the performance of a cell's final cover system (i.e., leachate quantities collected in the LCS) during the closure and post-closure periods;

- providing the capability in the valve houses to allow removal and replacement of the permanent LTS gravity line carrier pipe without disturbing the integrity of the permanent LTS gravity line containment pipe, if necessary;

- providing the capability in the valve houses to allow removal and replacement of the permanent LTS gravity line carrier pipe with a smaller diameter permanent LTS gravity line containment pipe and a smaller diameter permanent

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LTS carrier pipe (i.e., sliplining the containment pipe with a new small diameter dual-contained pipe);

- using materials inside the valve houses that are easily maintainable by on-site personnel; and
- reorienting the gravity drainage inlet structures adjacent to the valve houses, without impacting the performance of the OSDF surface-water management system.

CLOSURE

GeoSyntec appreciates the opportunity to work with FDF, and specifically the Aquifer Restoration/Wastewater Project Group, on the redesign of the LTS on this challenging project. We look forward to continuing to work with you and the Group during the detailed design effort. If you have any questions or comments, please do not hesitate to contact either of the undersigned.

Sincerely,

Dennis L. Vander Linde

Dennis L. Vander Linde, P.E.
Project Engineer

J. F. Beech

J. F. Beech, Ph.D., P.E.
Principal

Attachments

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RESULTS OF COMPARISON OF CONCEPTUAL DESIGN IDEA TO DCP

Design Criteria Package Section	Criteria Origin (Based on a review of documents associated with the DCP)			Design Criteria	Design Intent	Possibility of Inconsistency with Design Intent	Revise DCP (1)
	ARAR	Functional Requirement	Design Consideration				
2.5.3 A. Bullet 7 pg 2-50	OAC 3745-27-08(C)(5)(c)	Section 6.1.3 pg 6-3		Liquid in the leak detection system of an OSDF cell should flow by gravity through a double-wall HDPE pipe (which penetrates the liner system) to a leak detection system manhole located on the west side of the OSDF (outside the limit of impacted material disposal).	To have a passive system, to comply with OAC 3745-27-08(C)(5)(c), and to have double containment of liquid in the LDS.	No	No
2.5.3 A. Bullet 8 pg 2-50		Section 6.1.3 pg 6-3		Each OSDF cell should have its own leak detection system manhole.	To allow liquids from the LDS to be identified to a particular cell.	No	No
2.5.3 A. Bullet 8 pgs 2-50 and 2-51			X	The manhole should allow for direct discharge of flow from the leak detection system carrier pipe into a primary containment vessel located inside the manhole.	Gravity drainage of liquids to an observation sump.	No	No
2.5.3 A. Bullet 8 pg 2-51	OAC 3745-27-08(C)(5)(b)			The manhole should serve as a secondary containment structure for the primary containment vessel within the manhole.	To comply with OAC 3745-27-08(C)(5)(b) and to have double containment of liquids.	No	No
2.5.3 A. Bullet 8 pg 2-51		Section 6.1.3 pg 6-3		The leak detection manhole should allow for the monitoring of any liquid collected by the leak detection system and conveyed by the leak detection system carrier pipe into the primary containment vessel component of the manhole.	Enable visual as well as mechanical monitoring of liquids from a cell.	No	No
2.5.3 A. Bullet 8 pg 2-51	OAC 3745-27-08(C)(5)(a)		X	The leak detection system containment pipe should have a monitoring port and fixed end seal within the leak detection system manhole.	To comply with OAC 3745-27-08(C)(5)(a) and to enable liquids conveyed in the carrier pipe and containment pipe to be differentiated before entering the manhole.	No	No
2.5.3 A. Bullet 9 pg 2-51		Section 6.1.3 pg 6-3		The design should isolate the leak detection system manhole from the leachate collection system manhole during the period of active facility maintenance (i.e., during the initial post-closure period and some or all of the intermediate period described in Section 2.3 of the DCP).	To prevent leachate from the LCS from being able to be confused with liquids from the LDS.	No	Yes
2.5.3 A. Bullet 9 pg 2-51			X	The design should allow for accumulated liquids in the primary containment vessel to be pumped (during the period of isolation) from a suction line in the vessel into a gravity flow drain connected to the leachate transmission system gravity line.	A means to remove this leakage collected in the primary containment vessel was provided via a suction line, a portable external pump (to be supplied by the contractor), and an inlet pipe which connected to a gravity pipe flowing to the LTS. The pump and pump operator could remain external to the manhole during this operation.	No	No
2.5.3 A. Bullet 9 pg 2-51			X	The design should further allow for the activation of a gravity flow drain from the primary containment vessel to the leachate transmission system gravity line should such a line be called for at some time after final closure of the facility.	To allow gravity drainage of the LDS to the LTS as part of the latter final management strategy.	No	No
2.5.3 A. Bullet 9 pg 2-51			X	Each leak detection system manhole should have a cleanout (internal or external to the manhole) for maintaining the leak detection system carrier pipe and a high level alarm for the primary containment vessel of the manhole.	To allow flushing of the LDS carrier pipe similar to the functional requirement for the LCS pipe in Section 6.1.2 and to indicate the presence of liquids from the LDS.	No	No
2.5.3 A. Bullet 9 pg 2-51			X	The design should also provide access to install a sump pump in the vessel to allow pumping of construction water that drains from the leak detection system prior to the start of OSDF cell operation.	Liquids captured by the LDS during construction could be considerable. As such, a means to remove these liquids was provided via a suction line to the primary containment vessel, a portable external pump (to be supplied by the contractor), and an inlet pipe which connected to a gravity pipe flowing to the LTS.	No	Yes
2.5.3. A. Bullet 10 pg 2-51	OAC 37A5-27-08(C)(5)(c)	Section 6.1.2 pgs 6-2 and 6-3		Liquid in the leachate collection system of an OSDF cell should flow by gravity through a double-wall HDPE pipe (which penetrates the liner system) to a leachate collection system manhole located on the west side of the OSDF (outside the limit of impacted material placement).	To comply with OAC 3745-27-08(C)(5)(c) and to have a passive system which maintains double containment of liquids.	No	No

Notes: (1) Terminology changes between final design package and conceptual design idea are not reflected with a "yes".
(2) DCP to be revised for change in wall stresses from axial and radial to vertical and horizontal.

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RESULTS OF COMPARISON OF CONCEPTUAL DESIGN IDEA TO DCP

Design Criteria Package Section	Criteria Origin (Based on a review of documents associated with the DCP)			Design Criteria	Design Intent	Possibility of Inconsistency with Design Intent	Revise DCP (1)
	ARAR	Functional Requirement	Design Consideration				
2.5.3. A. Bullet 10 pg 2-51		Section 6.1.2 pgs 6-2 and 6-3		In the manhole, the leachate should discharge directly into the leachate transmission system gravity line.	To allow direct gravity drainage of leachate to a central sump (i.e., PLS).	No	No
2.5.3. A. Bullet 11 pg 2-52		Section 6.1.2 pgs 6-2 and 6-3		Each OSDF cell should have its own leachate collection system manhole.	To keep leachate generated by each cell separate until transmission to the central sump (i.e., PLS).	No	No
2.5.3. A. Bullet 11 pg 2-52	OAC 3745-27-08(C)(4)(b)(iii) and (iv)	Section 6.1.2 pgs 6-2 and 6-3		Each manhole should have cleanouts (internal or external to the manhole) for maintaining the leachate transmission system gravity line, the leachate collection system carrier pipe, and the redundant leachate collection system carrier pipe.	To comply with OAC 3745-27-08(C)(4)(b)(iii) and (iv) and to allow flushing of the LCS carrier pipe.	No	No
2.5.3. A. Bullet 11 pg 2-52	OAC 3745-27-08(C)(5)(a)			The leachate collection system carrier pipe in each manhole should have a sampling port for obtaining leachate samples for environmental sampling. This sampling port should also allow for the monitoring of leachate collection system flows from a cell after its closure.	To comply with OAC 3745-27-08(C)(5)(a) and to enable liquids conveyed in the carrier pipe to be sampled before being conveyed in the LTS pipe.	No	No
2.5.3. A. Bullet 11 pg 2-52		Section 6.1.2 pg 6-3	X	The leachate collection system carrier pipe should have temporary valve for regulating leachate flow into the gravity line during construction and periods of gravity line maintenance, extension, repair, etc. The design should require that the temporary valves be removed from each cell prior to final closure of the OSDF (so that, in the long term, there are no obstructions in the pipe).	The design capacity of the PLS is 200 gpm. In order to not exceed this value, the flow from each cell must be regulated using temporary valves. The valves shall be removed to allow free draining of leachate during the post-closure period and to allow maintenance.	No	No
2.5.3. A. Bullet 11 pg 2-52			X	The redundant carrier pipe should have a valve (secured in a closed position) and sampling port (for periodically confirming the absence of liquid in the pipe). The redundant carrier pipe valve should be configured so that it can be opened to allow flow to the leachate transmission system gravity line at a future date in the event of a failure of the primary leachate collection system pipe.	To prevent upgradient flow of leachate into the redundant pipe from the LTS pipe, to allow periodic observation to confirm the absence of liquids in the redundant pipe, and to allow redundancy for leachate transmission from a cell.	No	No
2.5.3. A. Bullet 11 pg 2-52	OAC 3745-27-08(C)(5)(a)		X	Both the primary and redundant leachate collection system containment pipes should have monitoring ports and fixed end seals within the leachate collection system manholes.	To comply with OAC 3745-27-08(C)(5)(a) and to enable liquids conveyed in the carrier pipe and containment pipe to be differentiated before entering the manhole.	No	No
2.5.3. A. Bullet 12 pg 2-52	OAC 3745-27-08(C)(5)(c) and OAC 3745-27-08(C)(4)(b)(iii)		X	The leachate transmission system gravity line should consist of double-wall HDPE pipe having a minimum nominal diameter for the carrier pipe of 6 in. The maximum pipe SDR should be 11.	To comply with OAC 3745-27-08(C)(5)(c) and OAC 3745-27-08(C)(4)(b)(iii). 6-in. diameter pipe was selected to allow access for conventional cleanout devices. The maximum SDR of 11 was selected to maximize pipe longevity under applied and environmental stresses. Dual containment was selected to allow the leachate lines to have a similar level of protection of the environment as an OSDF cell.	No	No
~~2.5.3 A. Bullet~~ 12 Sub-bullets 1 through 3 pgs 2-52 and 2-53	OAC 3745-27-08(C)(4) and 40 CFR 258.40		X	Base line flow rate during OSDF operation, FOS = 3.0; storm design-basis flow rate during OSDF operations, FOS = 1.0; and baseline design flow rate after OSDF closure, FOS =10.	To comply with OAC 3745-27-08(C)(4) and 40 CFR 258.40 and to establish flow rates to enable the LCS to be evaluated for compliance with the maximum 1-ft head requirement under possible operating conditions, including clogging.	No	No
2.5.3 A. Bullet 13 pg 2-53	OAC 3745-27-08(C)(5)(c)		X	The inner carrier pipe of the leachate transmission system gravity line should be continuous over its entire length (I.e. from its upgradient end to its discharge point).	To comply with OAC 3745-27-08(C)(5)(c) and to maintain separation of leachate being transmitted from upgradient cells from that collected from downgradient cells prior to transmission to the PLS. Also to allow the HDPE manhole to serve as secondary containment for the LTS carrier pipe.	No	No

Notes: (1) Terminology changes between final design package and conceptual design idea are not reflected with a "yes".
(2) DCP to be revised for change in wall stresses from axial and radial to vertical and horizontal.

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RESULTS OF COMPARISON OF CONCEPTUAL DESIGN IDEA TO DCP

Design Criteria Package Section	Criteria Origin (Based on a review of documents associated with the DCP)			Design Criteria	Design Intent	Possibility of Inconsistency with Design Intent	Revise DCP (1)
	ARAR	Functional Requirement	Design Consideration				
2.5.3 A. Bullet 13 pg 2-53	OAC 3745-27-08(C)(5)(a)		X	The outer containment pipe should be continuous between leachate collection system manholes, and open to the manholes.	To comply with OAC 3745-27-08(C)(5)(a) and to allow potential leakage from the carrier pipe to drain to an observation location (i.e., the inside of the manhole).	No	No
2.5.3 A. Bullet 13 pg 2-53	OAC 3745-27-08(C)(5)(a)			The leachate collection system manholes should be periodically inspected for the presence of liquid which could be indicative of a possible leak in the leachate transmission system carrier pipe or the leachate collection system pipe, valves, or fittings. The leachate collection system manholes should be equipped with liquid level alarms.	To comply with OAC 3745-27-08(C)(5)(a) to allow monitoring of potential leakage from the carrier pipes of the LTS, LCS, and redundant LCS.	No	No
2.5.3 A. Bullet 14 pg 2-53		Section 6.1.2 pg 6-3		The leachate transmission system gravity line should be located on the west side of the OSDF (outside of the limit of impacted material disposal). Once the OSDF is fully developed, the gravity line should run the length of the OSDF, from the first cell near the north end of the facility to the last cell near the south end of the facility. From the last cell, the gravity line should run to the permanent lift station.	To have leachate transmission occur on only one side of the facility with termination in a single central sump (i.e., PLS).	No	No
2.5.3 A. Bullet 14 pg 2-53			X	To promote gravity flow, the gravity line should be constructed with a minimum slope of 0.25 percent. (Note: Calculations indicate minimum 0.5 percent slope for a FOS = 8.9 under baseline gravity flow conditions. Calculations do not present results for condition of 0.25 percent slope of pipe).	To promote gravity flow.	No	No
2.5.3 A. Bullet 14 pgs 2-53 and 2-54			X	The gravity line should be buried in a trench at a sufficient depth below ground to prevent freezing of liquids in the line and damage due to traffic loads and other stresses. The gravity line should be adequately embedded in the trench.	To prevent freezing of transmitted leachate, effects of frost heave on the pipe slope, and damage from vehicle traffic loads.	No	No
2.5.3 A. Bullet 15 pg 2-54		Section 6.1.1 pg 6-2		The leachate transmission system gravity line and leachate collection system and leak detection system manholes should be installed in stages, progressively advancing from north to south in conjunction with the progressive development of the OSDF. Each stage may involve the installation of manholes and leachate transmission gravity line for one or several cells.	To allow the LTS to be constructed along with cell development which is dependent on the schedule for impacted material placement in the OSDF.	No	No
2.5.3. A. Bullet 15 pg 2-54		Section 6.1.2 pg 6-3		At a given stage, the leachate transmission gravity line should run through all of the leachate collection system manholes previously installed and those installed for a given stage to the southernmost manhole installed in that stage.	To have the permanent LTS line installed in phases along with phased development of the OSDF.	No	No
2.5.3. A. Bullet 15 pg 2-54				The southernmost manhole will serve as a connection point to a temporary gravity line. The leachate transmission gravity line should discharge directly in the temporary gravity line.	To allow double-containment to the PLS during phased development of the OSDF.	No	No
2.5.3. A. Bullet 16 pg 2-54			X	Liquids discharged into the temporary gravity line should flow to the permanent lift station at a minimum slope of 0.25 percent.	To promote gravity flow.	No	No

Notes: (1) Terminology changes between final design package and conceptual design idea are not reflected with a "yes".
(2) DCP to be revised for change in wall stresses from axial and radial to vertical and horizontal.

RESULTS OF COMPARISON OF CONCEPTUAL DESIGN IDEA TO DCP

Design Criteria Package Section	Criteria Origin (Based on a review of documents associated with the DCP)			Design Criteria	Design Intent	Possibility of Inconsistency with Design Intent	Revise DCP (1)
	ARAR	Functional Requirement	Design Consideration				
2.5.3. A. Bullet 16 pg 2-54	OAC 3745-27-08(C)(5)(c)			The temporary gravity line should consist of double-wall HDPE pipe having a minimum nominal diameter for the carrier pipe of 6 in. The maximum pipe SDR should be 11.	To comply with OAC 3745-27-08(C)(5)(c). 6-in. diameter pipe was selected to allow access for conventional cleanout devices. The maximum SDR of 11 was selected to maximize pipe longevity under applied and environmental stresses. Dual containment was selected to allow the leachate lines to have a similar level of protection of the environment as an OSDF cell.	No	No
2.5.3. A. Bullet 16 pg 2-54			X	A flow meter should be installed in the temporary [gravity line] to monitor the rate and volume of liquid sent to the permanent lift station.	The design capacity of the PLS is 200 gpm. In order to monitor for this value in the temporary gravity line and to ensure that the capacity of the PLS is not exceeded, a flow meter was selected for placement just upgradient of the PLS. Additionally, liquid level instrumentation and a motor-controlled valve located in the PLS will limit the flow rate into the PLS to less than 200 gpm. These two mechanisms provide a means to identify the flow rate into the PLS such that the valves in the LCS manholes can be positioned to throttle the flow rate to the PLS.	Yes	Yes
2.5.3. A. Bullet 16 pg 2-54			X	The temporary gravity line should be equipped with cleanout devices spaced along the pipe such that it can be maintained along its entire length.	To allow maintenance and access for cleanout equipment.	No	No
2.5.3. A. Bullet 16 pg 2-54		Section 6.1.2 pg 6-3	X	The permanent lift station should be located in proximity to the southwest corner of the OSDF.	A central sump is necessary to pump leachate, generated by the OSDF, to the biosurge lagoon. The location of this central sump (PLS) was selected to allow gravity drainage of leachate.	No	No
2.5.3 A. Bullet 16 pg 2-54			X	The permanent lift station should be installed concurrent with construction of the first OSDF cell.	To allow pumping of leachate generated by OSDF Cell 1 to the biosurge lagoon, the PLS was selected for construction concurrent with Cell 1 to perform this function, and connected to the leachate conveyance system which discharges to the biosurge lagoon.	No	No
2.5.3 A. Bullet 17 pg 2-54		Section 6.11.3 pgs 6-13 and 6-14	X	The pumps for the permanent lift station should be sized to pump liquid through a double-wall forcemain to the biosurge lagoon.	The pumps should be capable of providing the 200 gpm design flow rate to the biosurge lagoon for the design conditions of the leachate conveyance system.	No	No
2.5.3 A. Bullet 17 pg 2-54			X	The temporary gravity line should be designed to carry flow at the storm design-basis flow rate, which will be established as previously discussed in the section of the DCP. (Note: The pumps for the permanent lift station and the forcemain that will convey leachate from the permanent lift station to the biosurge lagoon will be designed as part of a separate design package).	The maximum flow rate that the temporary gravity line will be subjected to will be the storm design-basis flow rate. As such, the temporary gravity line should be design for this flow rate.	No	No
2.5.3. A. Bullet 18 pg 2-55			X	Unneeded portions of the temporary gravity line should be taken out of service as part of each subsequent stage of construction. At that time, the leachate transmission system gravity line should be extended to the next connection to the temporary gravity line or to the permanent lift station, as appropriate.	Abandoned temporary leachate gravity line should be removed prior to OSDF cell construction above the alignment of the pipe. The LTS should be connected to the temporary gravity line to allow flow of leachate generated by upgradient OSDF cells to the PLS.	No	No

Notes: (1) Terminology changes between final design package and conceptual design idea are not reflected with a "yes".
(2) DCP to be revised for change in wall stresses from axial and radial to vertical and horizontal.

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RESULTS OF COMPARISON OF CONCEPTUAL DESIGN IDEA TO DCP

Design Criteria Package Section	Criteria Origin (Based on a review of documents associated with the DCP)			Design Criteria	Design Intent	Possibility of Inconsistency with Design Intent	Revise DCP (1)
	ARAR	Functional Requirement	Design Consideration				
2.5.3 A. Bullet 19 pg 2-55	OAC 3745-27-08(C)(4)(e)			The permanent lift station shall be protected from adverse effects due to leachate and differential settlement. The lift station shall be equipped with an automatic high level alarm located no greater than 6 ft above the invert of the gravity line lift station inlet. Lift station pumps shall be of adequate capacity and shall automatically commence pumping before the accumulated leachate activates the high level alarm.	To comply with the OAC 3745-27-08(C)(4)(e). To ensure the integrity of the PLS. To have warning capabilities for high leachate levels. To have an operator independent pumping system to minimize high levels of leachate in the PLS.	No	No
2.5.3 A. Bullet 19 pg 2-55		Section 6.11.3 pgs 6-13 and 6-14	X	The lift station should also have a valve on the transmission line and a system for automatically closing the valve in the event of a power failure or if liquid levels in the lift station rise to an unacceptably high level (below the rim of the lift station or any level that would cause an electrical short or damage to equipment in the lift station).	To comply with OAC 3745-27-08(C)(4)(e) and to prevent overfilling the PLS and/or possible damage to the PLS electrical components.	No	No
2.5.3 A. Bullet 19 pg 2-55			X	A valve should be installed to provide a manual means for preventing flow into the lift station.	To allow leachate flow into the PLS to be temporarily prevented to permit maintenance or overfilling in an emergency situation.	No	No
2.5.3 A. Bullet 19 pg 2-55	OAC 3745-27-08(C)(5)(b) and OAC 3745-27-08(C)(5)(a)	Section 6.11.2 pg 6-13		The permanent lift station should be provided with secondary containment. The secondary containment system should be designed so that it can be monitored for the presence of leakage and should be equipped with a liquid level alarm.	To comply with OAC 3745-27-08(C)(5)(b) and OAC 3745-27-08(C)(5)(a) and to allow monitoring and notification of potential liquids from the PLS primary containment tank.	No	No
2.5.3 A. Bullet 20 pg 2-55			X	All manholes and the permanent lift station should be designed to withstand (with a factor of safety of 1.4) hydrostatic uplift due to perched groundwater. The design-basis perched ground-water contour map identified in Section 2.4.2 of this DCP should be used for the uplift evaluation. If the minimum factor of safety is not achieved in the calculations, the design-basis of the manholes should be modified as necessary. Potential modifications include extending the base of the manhole using secured gussets, and, if required, adding a concrete anchor ring around the base of the manhole.	To ensure that the LCS and LDS manholes and the PLS are designed to withstand hydrostatic uplift pressures.	No	No
2.5.3 A. Bullet 21 pg 2-55			X	Manholes should be designed to have a factor of safety of 2.0 against failure resulting from axial and radial wall stresses. The manholes should be evaluated for their adequacy with respect to radial crushing, radial buckling, axial crushing, and axial buckling. To satisfy these design criteria,.....	To ensure that the LCS and LDS manholes and the PLS are designed to withstand applied stresses.	No	Yes (2)
2.5.3 A. Bullet 22 pg 2-55			X	The temporary gravity line between the leachate transmission system gravity line and permanent lift station should be installed in a trench at a depth that does not interfere with the existing utilities. The pipe should be adequately bedded in the trench. Alternatively, the gravity line may be placed on or above existing ground and covered with a soil berm or insulation of sufficient thickness to protect the pipe from traffic loads, freeze-thaw, and other stresses. Layout of the gravity line to avoid interference with the utility corridor should be coordinated with FEMP site-wide planning activities. The temporary gravity line should have adequate strength to resist internal stresses caused by the pressure of the liquid flowing through the line.	To prevent freezing of transmitted leachate, effects of frost heave on the pipe slope, and damage from vehicle traffic loads. Also, to prevent disruption of the existing utilities on the area of the OSDF prior to their decommissioning.	No	No

Notes: (1) Terminology changes between final design package and conceptual design idea are not reflected with a "yes".
(2) DCP to be revised for change in wall stresses from axial and radial to vertical and horizontal.

RESULTS OF COMPARISON OF CONCEPTUAL DESIGN IDEA TO DCP

Design Criteria Package Section	Criteria Origin (Based on a review of documents associated with the DCP)			Design Criteria	Design Intent	Possibility of Inconsistency with Design Intent	Revise DCP (1)
	ARAR	Functional Requirement	Design Consideration				
2.5.3 A. Bullet 23 pg 2-55	OAC 3745-27-08(C)(5)(d)			The permanent lift station shall be capable of storing the quantity of leachate generated during a one-week period using design assumptions simulating final closure of the OSDF.	To comply with OAC 3745-27-08(C)(5)(d).	No	No
2.5.3 A. Bullet 23 pg 2-55			X	Potential storm surge flows from an OSDF cell into the leachate transmission system gravity line due to heavy precipitation into a newly opened cell should be regulated using throttling valves installed in conjunction with the flow meter in the temporary gravity line manhole so that the storm design-basis flow rate upon which the permanent lift station pump design is based is not exceeded.	The design capacity of the PLS is 200 gpm. In order to monitor for this value in the temporary gravity line and to ensure that the capacity of the PLS is not exceeded, a flow meter was selected for placement just upgradient of the PLS. Additionally, liquid level instrumentation and a motor-controlled valve located in the PLS will limit the flow rate into the PLS to less than 200 gpm. These two mechanisms provide a means to identify the flow rate into the PLS such that the valves in the LCS manholes can be positioned to throttle the flow rate to the PLS.	No	Yes
2.5.3 A. Bullet 24 pg 2-55		Section 6.11.3 pgs 6-13 and 6-14	X	The permanent lift station should have sufficient pump capacity to prevent the buildup of liquid in the manhole for the storm design-basis flow rate for the leachate transmission system gravity line.	The pumps in the PLS should have sufficient capacity to prevent the PLS from overfilling due to the storm design-basis flow rate.	No	No
2.5.3. A. Bullet 24 pg 2-55		Section 6.11.3 pgs 6-13 and 6-14	X	The lift station should have redundant pump capacity and automatic controls (with manual overrides) for operating the pumps.	To have two pumps in the PLS that are individually sized for the design flow rate, and if one were to be rendered inoperable, the other pump could pump the design flow rate and maintain operation of the pump station until the inoperable pump was repaired or replaced.	No	No
2.5.3 A. Bullet 25 pg 2-56		Section 6.11.3 pgs 6-13 and 6-14	X	The permanent lift station pumps should be designed to be conveniently removed from the lift station for periodic maintenance.	To allow easy removal of the pumps for maintenance.	No	No
2.5.3 A. Bullet 25 pg 2-56	OAC 3745-27-19(K)(2)	Section 6.11.3 pgs 6-13 and 6-14		Extra pumps for the permanent lift station should be maintained on the FEMP property for use during periods of pump servicing.	To comply with OAC 3745-27-19(K)(2).	No	No
2.5.3. A. Bullet 26 pg 2-57		Section 6.11.3 pgs 6-13 and 6-14	X	The permanent lift should contain pump controls, valves, and mechanical and electrical equipment to achieve the operational objectives described above.	To allow the PLS to be able to operated to management leachate from the OSDF.	No	No
2.5.3 A. Bullet 27 pg 2-57			X	The Systems Plan for the OSDF should describe the operational and maintenance activities necessary to achieve the operational objectives described above.	To have a document that describes the operational and maintenance activities necessary for the OSDF.	No	No

Notes: (1) Terminology changes between final design package and conceptual design idea are not reflected with a "yes".
(2) DCP to be revised for change in wall stresses from axial and radial to vertical and horizontal.

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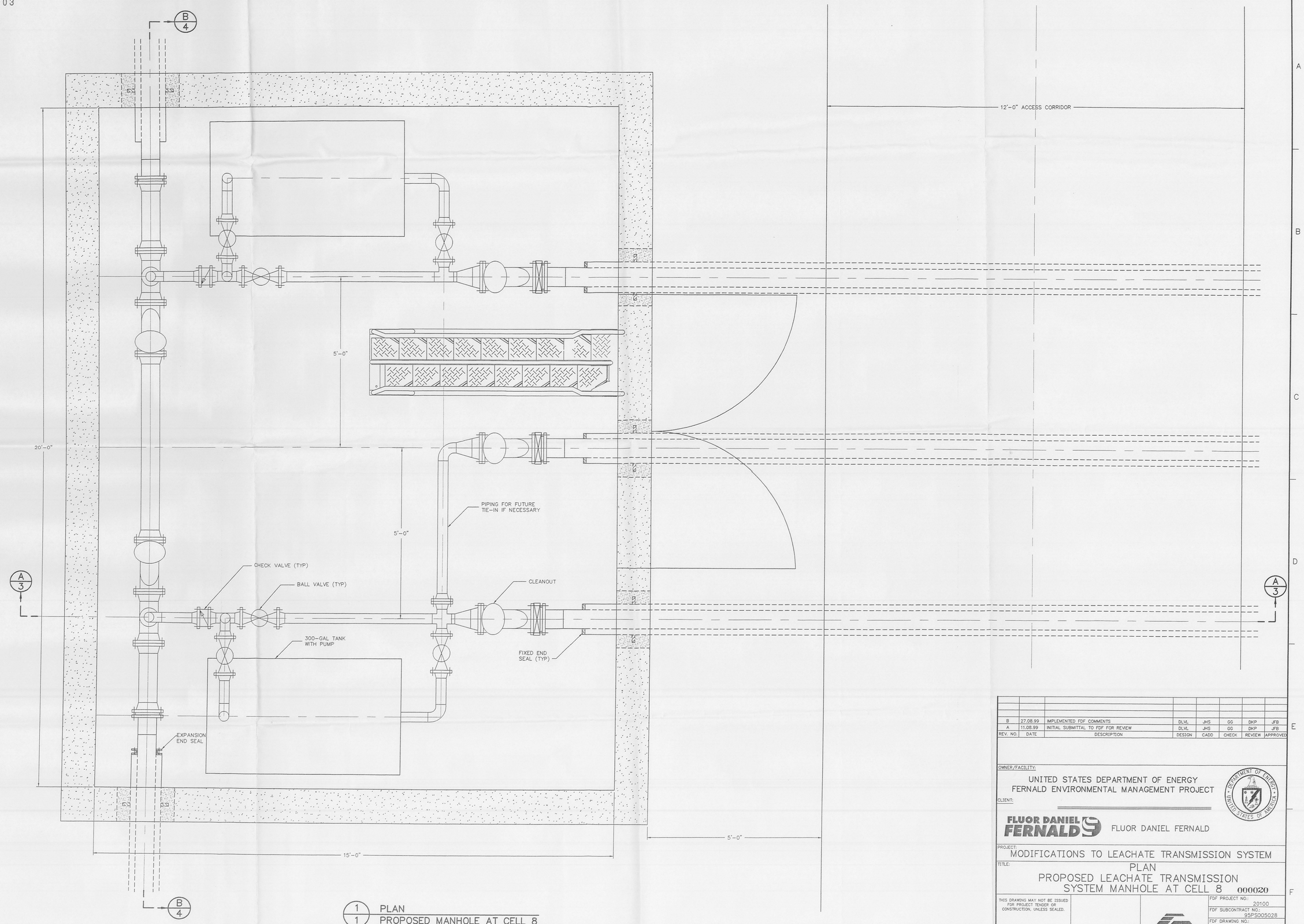
2703

PROPOSED REVISIONS TO DCP

Design Criteria Package Section to be Revised	Criteria Origin			Revised Design Criteria
	ARAR	Functional Requirement	Design Consideration	
2.5.3 A. Bullet 9 pg 2-51		Section 6.1.3. pg 6-3		The design should isolate the leak detection system ~~manhole~~ from the leachate collection system ~~manhole~~ during the period of active facility maintenance (i.e., during the initial post-closure period and some or all of the intermediate period described in Section 2.3 of the DCP).
2.5.3 A. Bullet 9 pg 2-51			X	The design should also provide access to install a sump pump in the ~~vessel~~ **valve house** to allow pumping of construction water that drains from the leak detection system prior to the start of OSDF cell operation.
2.5.3. A. Bullet 16 pg 2-54			X	A ~~flow meter and~~ **throttling valve** should be installed ~~in the temporary [gravity line]~~ **just upgradient of the permanent lift station** to ~~monitor~~ **control** the rate ~~and volume~~ of liquid sent to the permanent lift station.
2.5.3 A. Bullet 21 pg 2-55			X	~~Manholes~~ **Valve houses** should be designed to ~~have a~~ **minimum** ~~factor~~ **factors** of safety **of 1.5, 1.5 and 3.0 for overturning, sliding and bearing capacity, respectively,** ~~against failure resulting from axial and radial wall~~ **for applied vertical and horizontal** stresses. ~~The manholes should be evaluated for their adequacy with respect to radial crushing, radial buckling, axial crushing, and axial buckling.~~ To satisfy these design criteria, an analysis should be performed to evaluate the effects of lateral earth pressure and potential hydrostatic forces on the ~~manholes~~ **valve houses.** The analysis should consider the type of backfill material to be used around the ~~manholes~~ **valve houses** and the design-basis perched ground-water levels along the alignment of the leachate transmission system. If the minimum factor of safety is not achieved in the calculations, the design-basis for the ~~manholes~~ **valve houses** should be modified as necessary. ~~Potential modifications include increasing the manhole wall thickness, adding internal or external gussets, and changing the type of backfill to be placed around the manholes.~~
2.5.3 A. Bullet 23 pg 2-55			X	Potential storm surge flows ~~from an OSDF cell~~ into the leachate transmission system gravity line due to heavy precipitation into a newly opened cell should be regulated using throttling valves installed in conjunction with the ~~flow meter~~ **throttling valve** ~~in the temporary gravity line manhole~~ **just upgradient of the permanent lift station** so that the storm design-basis flow rate upon which the permanent lift station pump design is based is not exceeded.
New Design Criteria (Section Number to be Indentified)			X	The design should include a means to collect and measure liquids from the leachate collection system during the closure and post-closure periods to allow the permformance of the final cover system for a cell to be evaluated.

000019



1 / 1 PLAN
PROPOSED MANHOLE AT CELL 8
SCALE: 1" = 1'

REV. NO.	DATE	DESCRIPTION	DESIGN	CADD	CHECK	REVIEW	APPROVED
B	27.08.99	IMPLEMENTED FDF COMMENTS	DLVL	JHS	GG	DKP	JFB
A	11.08.99	INITIAL SUBMITTAL TO FDF FOR REVIEW	DLVL	JHS	GG	DKP	JFB

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD

PROJECT:
MODIFICATIONS TO LEACHATE TRANSMISSION SYSTEM

TITLE:
PLAN
PROPOSED LEACHATE TRANSMISSION
SYSTEM MANHOLE AT CELL 8

000020

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FDF PROJECT NO.:	20100
FDF SUBCONTRACT NO.:	95PS005028
FDF DRAWING NO.:	90X-6000-M-00236
GEOSYNTEC PROJECT NO.:	GG05713-06.1
GEOSYNTEC DOCUMENT NO.:	F99-B254
SHEET NO.:	2
REVISION NO.:	B

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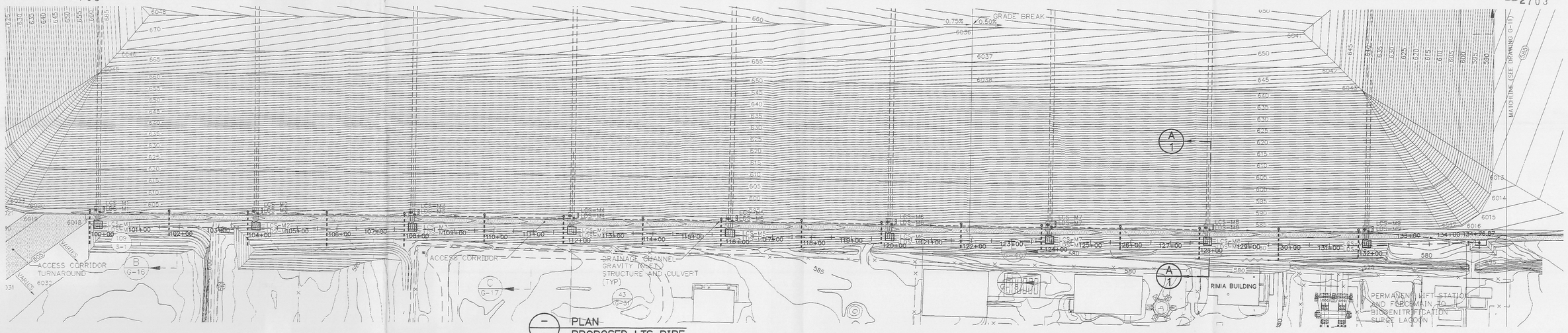
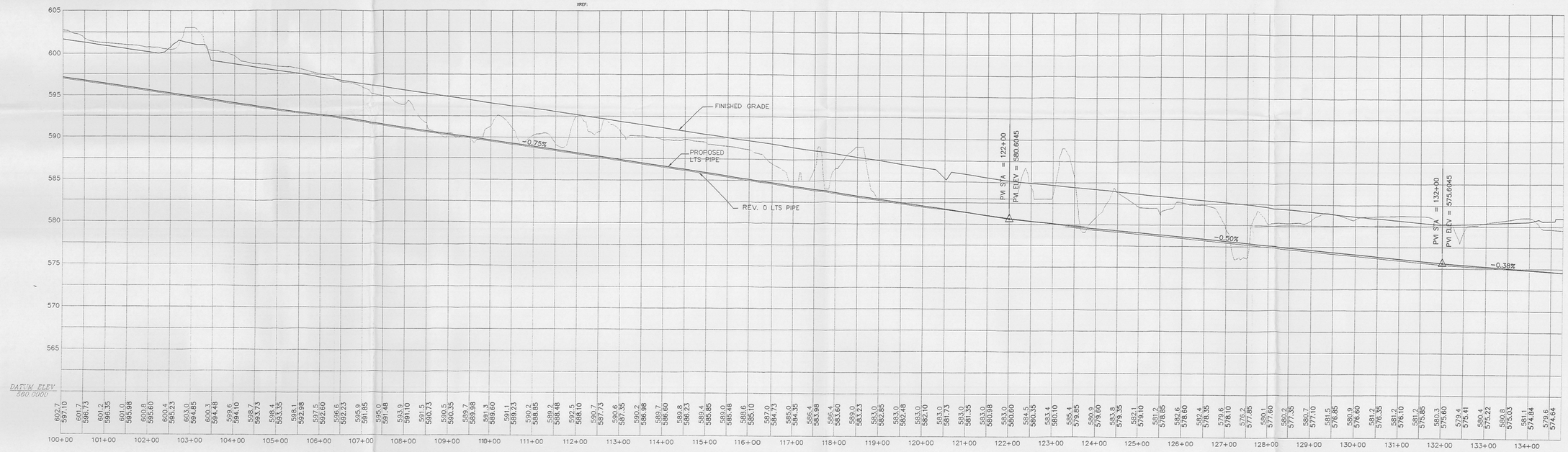
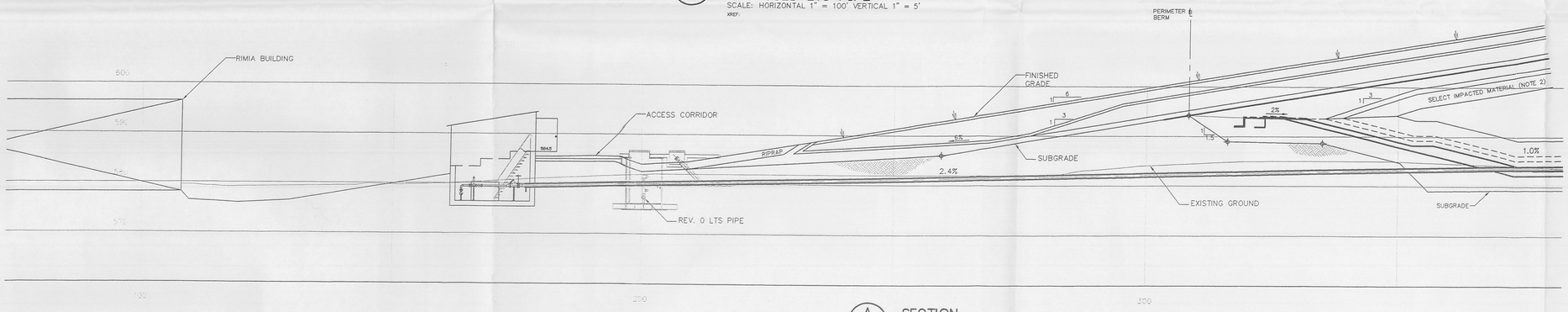


PLAN
PROPOSED LTS PIPE
SCALE: 1" = 100'
XREF:



PROFILE
PROPOSED LTS PIPE
SCALE: HORIZONTAL 1" = 100' VERTICAL 1" = 5'
XREF:



A/1 SECTION
CELL 8 LCS PIPE
SCALE: 1" = 10'
XREF: F99XB017.DWG

REV. NO.	DATE	DESCRIPTION	DESIGN	CADD	CHECK	REVIEW	APPROVED
B	27.08.99	IMPLEMENTED FDF COMMENTS	DLVL	JHS	GG	DKP	JFB
A	11.08.99	INITIAL SUBMITTAL TO FDF FOR REVIEW	DLVL	JHS	GG	DKP	JFB

100 50 0 100 200
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD

PROJECT:
MODIFICATIONS TO LEACHATE TRANSMISSION SYSTEM

TITLE:
PLAN AND PROFILE
PROPOSED LEACHATE TRANSMISSION SYSTEM

000021

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FDF PROJECT NO.:	20100
FDF SUBCONTRACT NO.:	95PS005028
FDF DRAWING NO.:	90X-6000-G-00235
GEOSYNTEC PROJECT NO.:	GO0573-06.1
GEOSYNTEC DOCUMENT NO.:	F99-B253
SHEET NO.:	1
REVISION NO.:	B

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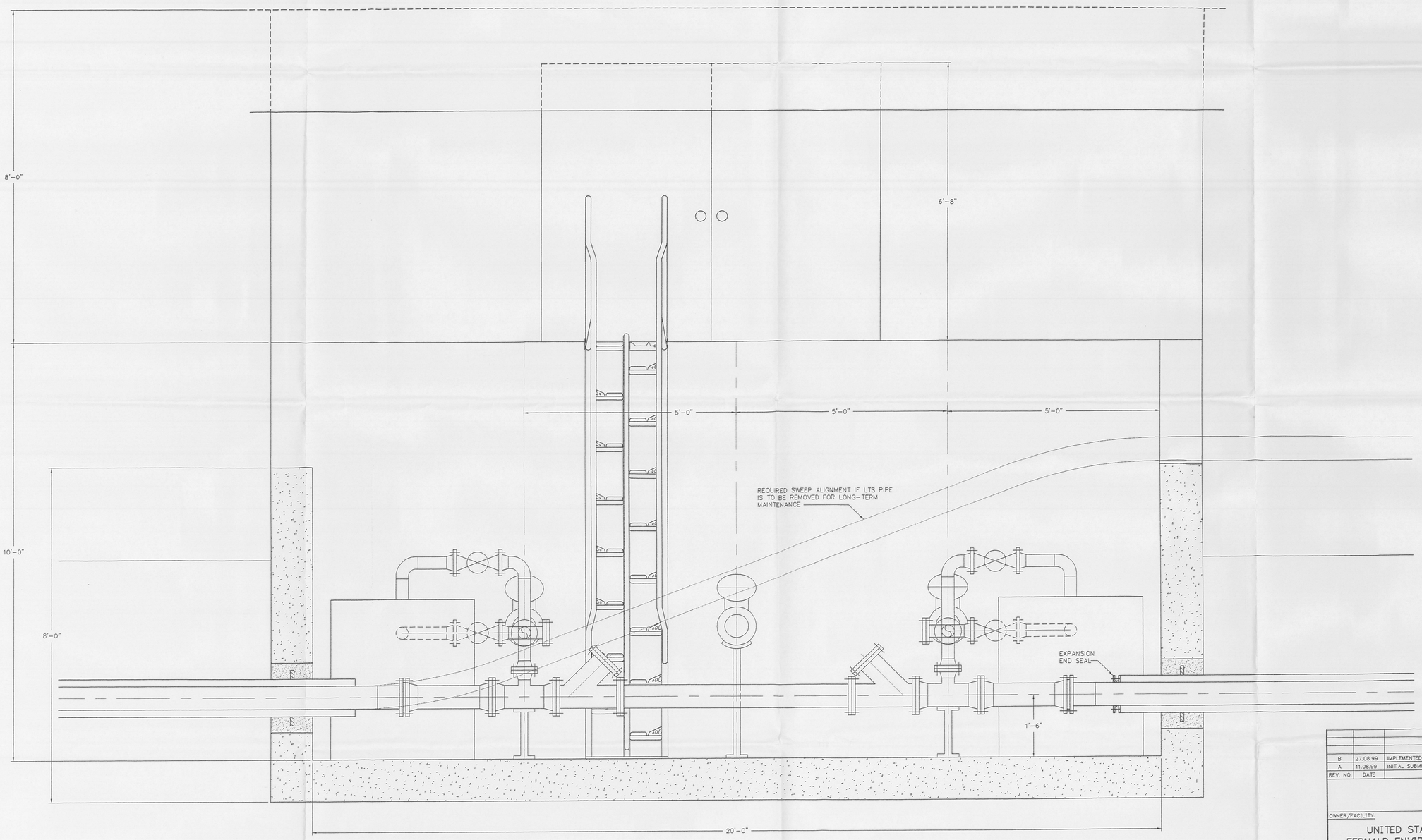

B / 4 SECTION TO EAST
PROPOSED MANHOLE AT CELL 8
SCALE: 1" = 1'

REV. NO.	DATE	DESCRIPTION	DESIGN	CADD	CHECK	REVIEW	APPROVED
B	27.08.99	IMPLEMENTED FDF COMMENTS	DLVL	JHS	GG	DKP	JFB
A	11.06.99	INITIAL SUBMITTAL TO FDF FOR REVIEW	DLVL	JHS	GG	DKP	JFB

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UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD

PROJECT:
MODIFICATIONS TO LEACHATE TRANSMISSION SYSTEM

TITLE:
SECTION TO EAST
PROPOSED LEACHATE TRANSMISSION
SYSTEM MANHOLE AT CELL 8

000022

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FDF PROJECT NO.:	20100
FDF SUBCONTRACT NO.:	95PS005028
FDF DRAWING NO.:	90X-6000-M-00238
GEOSYNTEC PROJECT NO.:	G00573-06.1
GEOSYNTEC DOCUMENT NO.:	F99-B256
SHEET NO.:	4
REVISION NO.:	B

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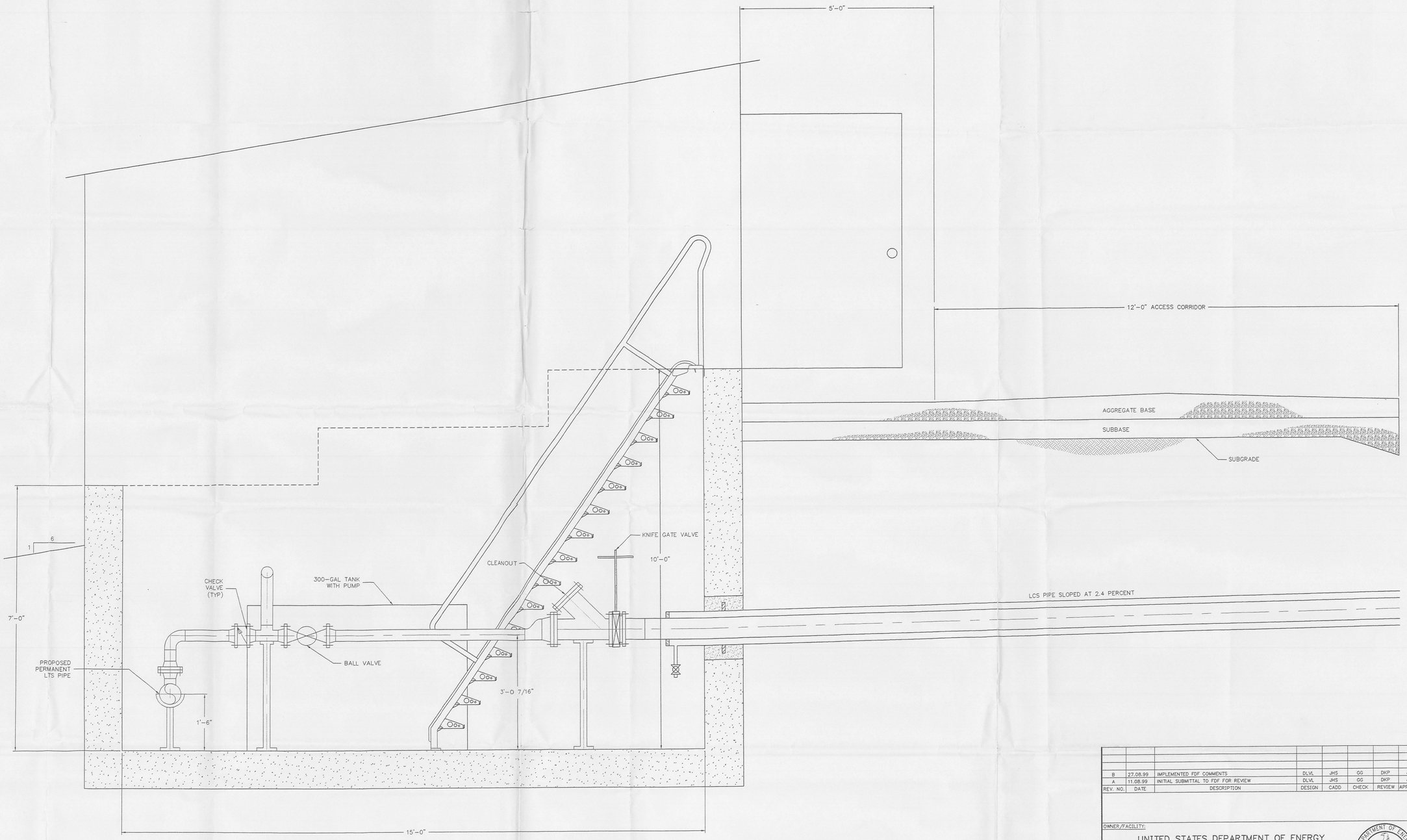

A/3 SECTION TO NORTH
PROPOSED MANHOLE AT CELL 8
SCALE: 1" = 1'

REV. NO.	DATE	DESCRIPTION	DESIGN	CADD	CHECK	REVIEW	APPROVED
B	27.08.99	IMPLEMENTED FDF COMMENTS	DLVL	JHS	GG	DKP	JFB
A	11.08.99	INITIAL SUBMITTAL TO FDF FOR REVIEW	DLVL	JHS	GG	DKP	JFB

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UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD

PROJECT:
MODIFICATIONS TO LEACHATE TRANSMISSION SYSTEM

TITLE:
SECTION TO NORTH
PROPOSED LEACHATE TRANSMISSION
SYSTEM MANHOLE AT CELL 8

000023

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FDF PROJECT NO.:	20100
FDF SUBCONTRACT NO.:	95PS005028
FDF DRAWING NO.:	90X-6000-M-00237
GEOSYNTEC PROJECT NO.:	G00573-06.1
GEOSYNTEC DOCUMENT NO.:	F99-B255
SHEET NO.:	3
REVISION NO.:	B

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