SKYLINE LANDFILL
CITY OF FERRIS
DALLAS AND ELLIS COUNTIES, TEXAS
TCEQ PERMIT APPLICATION NO. MSW 42D

PERMIT AMENDMENT APPLICATION

PART III – FACILITY INVESTIGATION AND DESIGN
ATTACHMENT F
GROUNDWATER MONITORING PLAN

Prepared for

Waste Management of Texas, Inc.

April 2012

Revised August 2012

STATE OF TEXAS
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8-21-2012

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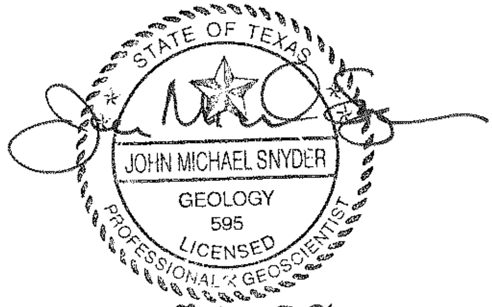

8-21-2012

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GROUNDWATER MONITORING SYSTEM DESIGN CERTIFICATION

General Site Information

Site: Skyline Landfill

Site Location: City of Ferris, Dallas and Ellis Counties, Texas

MSW Permit Application No.: 42D

Qualified Groundwater Scientist Statement

I, Michael Snyder, am a licensed professional geoscientist in the State of Texas and a qualified groundwater scientist as defined in §330.3. I have reviewed the groundwater monitoring system and supporting data contained herein. In my professional opinion, the groundwater monitoring system is in compliance with the groundwater monitoring requirements specified in 30 TAC §330.401 through §330.421. This system has been designed for specific application to the Skyline Landfill (Permit Application No. MSW 42D). The only warranty made by me in connection with this document is that I have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of my profession, practicing in the same or similar locality. No other warranty, expressed or implied, is intended.

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STATE OF TEXAS
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Signature: ______________________
Michael Snyder, P.G. No. 595 - Texas

Date: 8-21-2012

1 SITE HYDROGEOLOGY

Two subsurface stratigraphic units have been identified at the site. They include Stratum I, weathered Taylor Marl, and Stratum II, unweathered Taylor Marl. The Taylor Marl is a very dense, low permeability formation consisting of calcareous clays (marl). Several hundred feet of Taylor exists beneath the site. The uppermost regional aquifer is the Woodbine formation, which is more than 1100 feet beneath the site and separated from the site by the very low permeability materials of the Taylor, Austin, and Eagle Ford formations. These formations consist of clay, marl, shale, and fine grained limestone (Austin).

Groundwater occurs from the infiltration of precipitation and moves laterally within the weathered Taylor Marl and in the upper parts of the unweathered Taylor. Some of the material that is traditionally called unweathered marl because it is gray actually may contain weathered textures a few feet into the gray marl or clay. Groundwater flows laterally in a flow direction influenced by the depth of weathering. A conceptual hydrogeologic cross section is included in Attachment E, Appendix E6 as Figure E6-910. The excavation at the sitein the expansion area is extended down into the unweathered Taylor where placement of composite liners has cut off normal groundwater flow in the permeable parts of the Taylor. In the existing cells, most of the weathered area has been removed. Where it still exists it only remains in small isolated discontinuous areas, cut off from infiltration and recharge. Areas where the unweathered Taylor still remain after excavation are shown on Attachment E, Appendix E3, Figure E3-1 and Appendix E6, Figure E6-12. Groundwater is diverted around the excavation. Placement of waste, daily cover soil, intermediate cover soil, a leachate collection system, and eventually final cover will prevent infiltration of precipitation in the area covered by the waste footprint. These factors have altered normal groundwater flow. Groundwater now flows from the south toward the north and is diverted around the site. Infiltration recharge still occurs on the upgradient and downgradient parts of the site. In those areas groundwater flows more normally in a pattern related to the topography and the shape of the unweathered surface. In many places on the downgradient side of the site groundwater flows parallel to the point of compliance. A conceptual hydrogeologic cross section and hydrogeologic model are included as Figures E6-9 10 and E6-10 11 in Attachment E, Appendix E6.

1.1 Groundwater Flow Direction and Rate

Groundwater occurs at the site in the weathered Taylor Marl and upper part of the unweathered Taylor Marl. Groundwater flow is structurally controlled and mimics the topography. Permeability in the Taylor Marl is related to the depth of weathering of the Taylor and is thus related to the surface topographic expression. The structural contour map of the top of the unweathered Taylor map (included in Attachment E as Figure E3-128) shows a strong resemblance to the topography. Groundwater in the Taylor Marl at the site flows from the south end of the site to the north, generally toward Ten

Mile Creek. Groundwater flow direction is influenced by the depth of weathering and the unweathered surface (Figure E3-6), which is influenced by the topography (Figure E6-89). Minor fluctuations in the unweathered surface and thus the potentiometric surface show minor variations in the groundwater flow directions to the northwest and northeast perimeters. Groundwater flow from the south is diverted around the composite lined excavation. Normal groundwater flow directions prevail north of the site as precipitation infiltration reaches the water table. A conceptual hydrogeologic cross section and a conceptual hydrogeologic flow model are included as Figures E6-9 10 and E6-1011. The excavation is extended well into the low permeability unweathered Taylor in the expansion area. Where it still exists it only remains in small isolated discontinuous areas which are cut off from infiltration and recharge. As such, a leachate leak is unlikely to migrate into the weathered Taylor groundwater.

The original site characterization included in the 1991 permit application showed multiple piezometers installed to identify groundwater in the weathered Taylor. A table of water levels from piezometers is included in Attachment E as Table E-11. A pre-excavation potentiometric surface map from 1991 is included in Attachment E as Figure E6-78. Most of the piezometers demonstrated groundwater occurrence during the characterization. Thirty-five piezometers were installed in clustered locations, and piezometers at all locations encountered groundwater during the characterization period of 1987-1993. Water levels from existing monitoring wells are included in Attachment E as Table E-10. As shown in the table, the areas near MW-4, MW-5, MW-7, and MW-13 are now consistently dry.

Initial development occurred with excavation of Cell 1 in the center of the site (see Figure E6-12 in Appendix E6 of Attachment E). This cell opened in 1995 so excavation was completed prior to that. Cell development then moved southward. By 1999 excavation and cell development had proceeded through the center of the site to southern extent of the site. All development then moved clockwise from south to north along the west side.

Cell development consists first of excavation of the Taylor Marl. The process of excavation and the accompanying dewatering creates an inward gradient. Once the liner and underdrain are installed, the inward gradient persists. Also, when the liner is installed, recharge by infiltration of precipitation to the Taylor beneath the liner is prevented by the liner.

There are currently three areas along the site perimeters where monitoring wells are dry. ~~First, on the west side, MW-3R, MW-4, and MW-5 are dry. MW-3R was dry upon installation in 2007 but has produced water since June 2009. MW-4 and MW-5 have been dry since at least 2001, except for two instances.~~First, on the west side MW-4 has only had groundwater one time during the last eleven years. Monitoring well MW-5 has never had water. MW-2R and 3R have recently exhibited groundwater levels and additional monitoring wells have been added in those areas (MW-27 and 28). MW-12 and MW-25 (north and south of MW-13) now exhibit groundwater and two new wells are proposed in those areas (MW-29 and 30).

The second area, near MW-7 on the north side, initially had water and then was intermittently dry through 2010, except for two instances. Since 2010 MW-7 has remained typically dry and only had water during two monitoring events. MW-6, located on the northwest side between MW-5 and MW-7 (both of which are dry), currently has water but has been periodically dryis currently dry but did have water in March 2012. However, MW-6 had previously been dry since March 2010. Monitoring well MW-21 (located between MW-6 and MW-7) has been dry since June January 2011.

Finally, there is the area near MW-13 on the northern end of the east side of the site. MW-13 has been dry since December 2001. Monitoring well MW-26 has been dry since installation (September 2009)MW-13 was installed in December 2001 and has never had water.

Figure F1-1 shows comparisons of water levels from existing monitoring wells and water levels from original piezometers near those monitoring wells.

Because the entire upgradient (south) end of the site was excavated, lined, and filled early in the site history, precipitation infiltration that would otherwise have flowed northward to the downgradient end of the site has been prevented. As the excavation and fill sequence has progressed along the west side, monitoring wells on the west (MW-4 and MW-5) are now dry. In addition, MW-7 and occasionally MW-6 and new monitoring well MW-21 along the northeast part of the site are dry. As cell development continues, additional wells will become dry or at least intermittently dry. Some areas in the southern part of the site are still open ground, still capable of receiving precipitation and infiltration.

Multiple potentiometric surface maps were created over both temporal and seasonal variations and are included in Attachment E, Figures E6-1 through E6-56. These maps reflect the altered groundwater flow pattern created by the placement of the lined excavations that extend well into the unweathered Taylor. Groundwater contours reflect "no flow" boundaries adjacent to the excavation and the dry areas near MW-4 and MW-5 on the west and MW-13 on the east. On the downgradient side of the site (north boundaries) groundwater flow follows the topography and the unweathered surface and in places flows parallel to the site boundaries. Groundwater flow velocity is estimated to be approximately 2.01×10^{-4} ft/yr in Stratum I (Attachment E, Appendix E6, Figure E6-67).

1.2 Groundwater Flow Direction in pre-Subtitle D Area and Phase 5 Area

Most of the pre-Subtitle D area is lined with compacted clay liner. The eastern side of the pre-Subtitle D area is excavated into the unweathered Taylor. Therefore, groundwater is diverted around the excavation in this area. The Phase 5 area is lined with Subtitle D liner which also would divert groundwater around the area.

2 OPERATIONAL CONSIDERATIONS FOR GROUNDWATER SYSTEM DESIGN

2.1 Relationship of Excavation Bottom to Uppermost Aquifer

The excavation of the Skyline Landfill is designed to remain in the clayey Taylor Marl formation. The excavation extends well into the less permeable unweathered clay in the expansion area. Where it still exists it only remains in small isolated discontinuous areas which are cut off from infiltration and recharge (see Figure E6-12 in Appendix E6 of Attachment E). Weathering and thus permeability decrease with depth. Groundwater flows horizontally near the interface of the weathered and unweathered marl. The unweathered marl correlation is based on the color change from tan-gray to gray shale. Some weathering occurs below the top of the color change and thus the upper part of the gray (unweathered) marl may slowly transmit groundwater and is in communication with the weathered marl. The excavation is bottomed well into the unweathered Taylor at least 40 feet over much of the site. Recharge to the Taylor by infiltration of precipitation may be diminished by placement of waste and containment layers in the waste footprint area. Groundwater flow patterns are altered as groundwater is diverted around the excavation cells where they are lined with a composite liner.

2.2 Leachate Sump Design

The Skyline Landfill containment system and excavation are designed to accommodate a Subtitle D leachate collection system (LCS). The excavation bottom over the site is now lined with a composite liner and is sloped to direct leachate flow to the lowest areas where sumps are designed to collect the leachate. Leachate is then pumped out of the sumps. While leachate will not remain for lengthy periods of time nor at significant depths, the sump locations are the lowest areas of the excavation. While a leak from the Subtitle D cell is unlikely, if one were to occur, it would be more likely to be at the lowest leachate collection points in the sumps. Since the sumps are located in the unweathered Taylor Marl and migration of a contaminant is not possible in the unweathered Taylor Marl, no monitoring wells are necessary or useful in the unweathered Taylor Marl. Sump locations at the Skyline Landfill are shown on Figures F1-2 and F1-3. There are a total of eight sumps in the leachate sump design at the Skyline Landfill. Monitoring wells are located downgradient from each sump.

2.3 Critical Receptors

Critical receptors to groundwater flow downgradient of a landfill could include public drinking water supply wells, individual drinking water or livestock wells, and surface water bodies used for drinking water supply. There are a total of three individual domestic wells to the east and south of the site. These wells are screened in the Woodbine, several hundred feet deeper than the Taylor Marl formation and are separated by several hundred feet of low permeability Cretaceous shales and limestone. The top of the Woodbine is approximately 1,100 feet below the surface of the site.- The wells are located upgradient from the site. One public water supply well (602) is located directly east of the site. This well is also screened in the Woodbine, which is several hundred feet deeper than the Taylor Marl Formation and is separated by several hundred feet of low permeability Cretaceous shales and limestones. The nearest surface water body is Ten Mile Creek, which is located several hundred feet north of the site.

3 SUBTITLE D GROUNDWATER MONITORING SYSTEM

This site has an existing Subtitle D groundwater monitoring system that was certified by a qualified groundwater scientist (defined in 30 TAC §330.3) as being in compliance with 30 TAC §330.401 through §330.409.

The existing groundwater monitoring system (Figure F1-2) consists of a total of twenty-six (26) wells that monitor groundwater in the Stratum I marl (uppermost aquifer). The groundwater monitoring system design certification was most recently accepted by the TCEQ on April 10, 2009. Based on recent groundwater contours, four of the wells are upgradient (MW-1, MW-17, MW-18, and MW-20R) and the remaining twenty-two are downgradient (MW-2R, MW-3R, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, MW-19, MW-21, MW-22, MW-23, MW-24, MW-25, and MW-26). The point of compliance is shown on Figure F1-2.

See Section 3.5 – Monitoring Well Design and Construction and Figure F1-4 – Typical Monitoring Well Detail for monitoring well construction information.

3.1 Monitoring Well Locations

For groundwater monitoring purposes, the groundwater zone beneath the Skyline Landfill has been identified as the weathered Taylor Marl. Although not an aquifer by TCEQ definition or standard hydrogeological terminology, groundwater occurs in the weathered Taylor and upper parts of the unweathered Taylor. The Taylor Marl is present and is correlatable across the site. Groundwater enters the Taylor Marl south of the site (upgradient). Monitoring wells are designed to be screened across the interface of the weathered/unweathered Taylor Marl contact.

Four monitoring wells will need to be replaced because of the change in the footprint. These monitoring wells are now located either within the proposed waste footprint or outside of the 500-foot maximum distance from waste. Monitoring wells MW-8, MW-11, MW-21, and MW-22 will be plugged and replaced with MW-8R, MW-11R, MW-21R, and MW-22R, as shown on Figure F1-3.

MW-2R and 3R have recently exhibited groundwater levels and additional monitoring wells have been added in those areas (MW-27 and 28). MW-12 and MW-25 (north and south of MW-13) now exhibits groundwater and two new wells are proposed in those areas (MW-29 and 30). ~~One~~ Five monitoring wells (MW-27 through MW-31) ~~is~~ are being added to the network. MW-31 has been added to the southeast flank of the POC between MW-19 and MW-15 to comply with the 600-foot spacing requirement. The proposed monitoring system will consist of ~~27~~ 31 wells, of which 4 are upgradient and ~~23~~ 27 are downgradient (Figure F1-3).

3.2 Design Criteria

The existing groundwater monitoring system for the Skyline Landfill (Figure F1-2) was designed and is operated in accordance with those rules and was certified by a qualified groundwater scientist. The waste fill excavation is founded in the Taylor Marl formation. The weathered Taylor and upper part of the unweathered Taylor, although not an aquifer, is the uppermost groundwater zone for monitoring purposes. The proposed modifications to the Skyline Landfill groundwater monitoring system are also designed in accordance with the required elements of the stated regulations and have also been designed so that the monitoring well spacing does not exceed 600 feet or is demonstrated to be adequate. In some cases where the groundwater flow direction is parallel or near parallel to the site boundary monitoring wells are actually monitoring the same flow paths and are thus redundant. In order to achieve a groundwater monitoring system design to comply with §330.403, the following criteria listed in Table F-1 were followed. The table lists the location of the appropriate section where the required information is located in this application.

Those areas where the distance between monitoring wells exceeds 600 feet were approved by TCEQ based on a site-specific demonstration as required by 30 TAC §330.401(b). The TCEQ approval letter dated April 14, 2009, is included as Figure F1-5 in Appendix F1.

Because normal recharge caused by infiltration of precipitation has been cut off over a larger area (the landfill footprint), water levels may be lower than normal in some areas. Because of this, several monitoring wells are periodically dry. Wells MW-2R, MW-3R, MW-4, and MW-5 on the west side of the site are frequently dry. MW-7 on the north side of the site is dry. MW-12 and MW-13 on the northeast side of the site are also often dry, indicating that normal recharge and thus groundwater flow in those areas has been cut off.

Table F-1
Skyline Landfill
Groundwater Monitoring System
Design Criteria

Criterion	Location of Information in this Report
Identify and Characterize the Uppermost Aquifer	Section 1 – Site Hydrogeology
Establish Groundwater Flow Direction and Rate	Section 1.1 – Groundwater Flow Direction and Rate
Evaluate Potential Impacts of Operational Attributes of the Facility on Groundwater Flow	Section 2.1 – Relationship of Excavation Bottom to Uppermost Aquifer Section 2.2 – Leachate Sump Design
Determine Impacts to Critical Receptors	Section 2.3 – Critical Receptors
Determine the Appropriate Locations and Screened Intervals of Groundwater Monitoring Wells	Section 3.1 – Monitoring Well Locations Section 3.2 – Design Criteria Figure F1-4 – Typical Monitoring Well Detail

3.3 Contaminant Pathway Analysis

In the unlikely event of a leachate release (i.e., failure of multiple, redundant engineered containment systems such as composite liners and a leachate collection system), contaminants would move downward through the unsaturated portion of the weathered Taylor Marl, where present.

If the leachate were to reach the groundwater, the miscible contaminants would be diluted by the groundwater and would move laterally, downgradient (northward). Due to the relative difference in hydraulic conductivity between the weathered portions of the Taylor Marl and the deeper unweathered Taylor Marl, leachate migration in the lower clay confining layer is unlikely.

3.4 Sampling and Analysis Procedures

Appendix F2 – Groundwater Sampling and Analysis Plan contains the general requirements, sampling procedures and methods, and statistical analysis information required in 30 TAC §330.405(a)-(f).

3.5 Monitoring Well Design and Construction

In accordance with §330.421 – Monitor Well Construction Specifications, a licensed Texas driller will install monitoring wells in accordance with the regulations. Wells will be drilled by a method that will not introduce contaminants into the borehole or casing. A licensed professional geoscientist or engineer who is familiar with the geology of the area will supervise monitoring well installation and development and will provide a log of the boring. Equivalent alternatives to TCEQ requirements may be used if prior written approval is obtained from the executive director. Monitoring well construction details including screen intervals, well locations and elevations, filter pack and bentonite seal elevations, and surface completion are shown on Figure F1-4. Monitoring well construction will be completed in accordance with §§330.63, 330.403, and 330.421.

If any fluid is required in the drilling of monitoring wells, clean, treated city water shall be used and a chemical analysis provided to the executive director. No glue or solvents will be used in monitoring well construction.

After installation, monitoring wells will be developed to remove drilling artifacts and open the water-bearing zone for maximum flow until all water used or affected during drilling activities is removed and field measurements of pH, specific conductance, and temperature are stabilized.

A registered professional land surveyor will survey the well location and elevation.

Within 60 days of completion of a monitoring well or any other part of a monitoring system, an installation report will be submitted. The report will include construction and installation details for each well on forms available from the commission, a site map drawn to scale showing the location of all monitoring wells and the relevant point(s) of compliance, well elevations to the nearest 0.01 foot above msl (with year of datum shown), latitude and longitude or landfill grid location of each well, copies of detailed geologic logs including soil sample data, and copies of driller's reports required by other agencies.

Damaged monitoring wells that are no longer usable will be reported to the executive director for a determination whether to replace or repair the well. In accordance with 30 TAC §305.70, if a compromised well requires replacement a permit modification request will be submitted within 45 days of the discovery.

Plugging and abandonment of monitoring wells will be performed in accordance with 16 TAC §76.702 and §76.1004. No abandonment will be performed without prior written authorization.

All parts of the groundwater monitoring system will be operated and maintained so that they perform at least to design specifications throughout the life of the groundwater monitoring program.

The facility must notify the executive director if changes in site construction or operation or changes in adjacent property affect or are likely to affect the direction and rate of groundwater flow and the potential for detecting groundwater contamination from the facility.

STATE OF TEXAS
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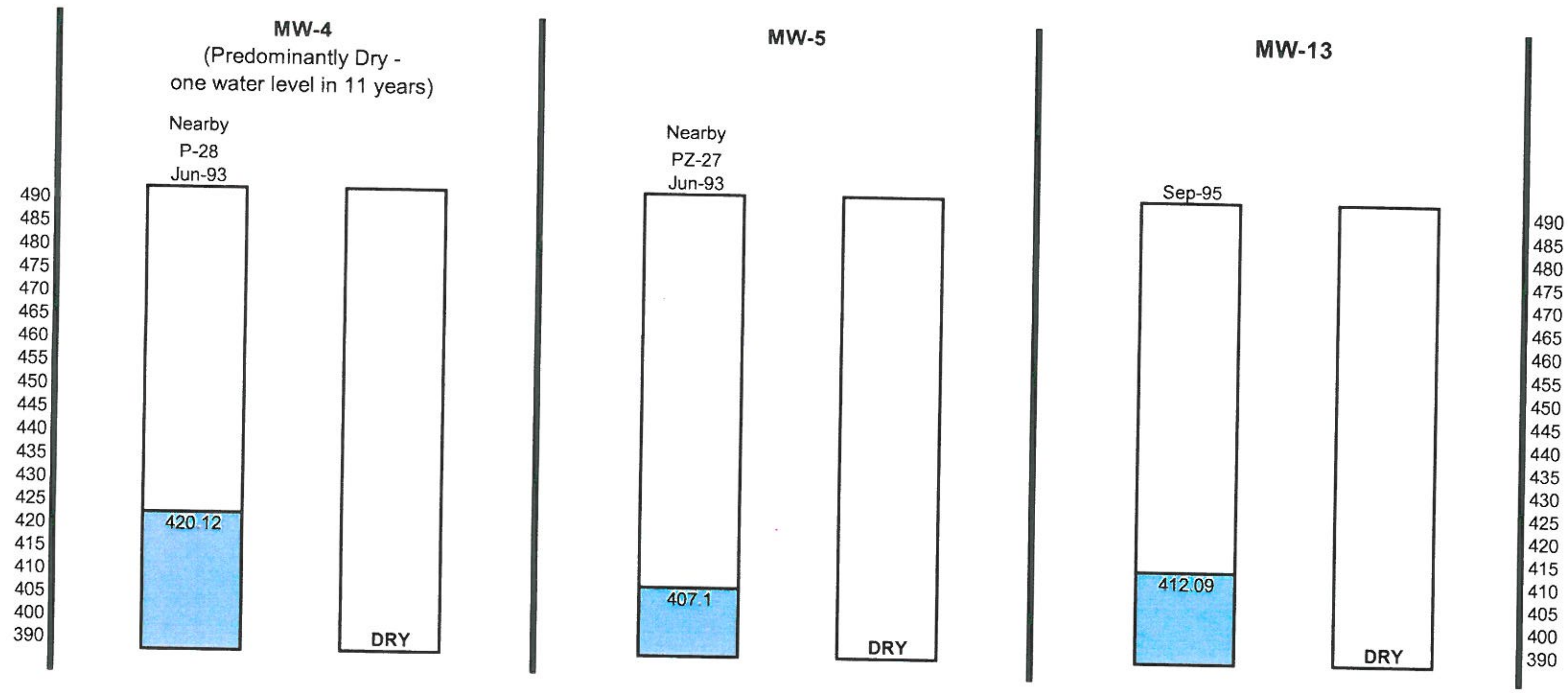
8-21-2012

SKYLINE LANDFILL

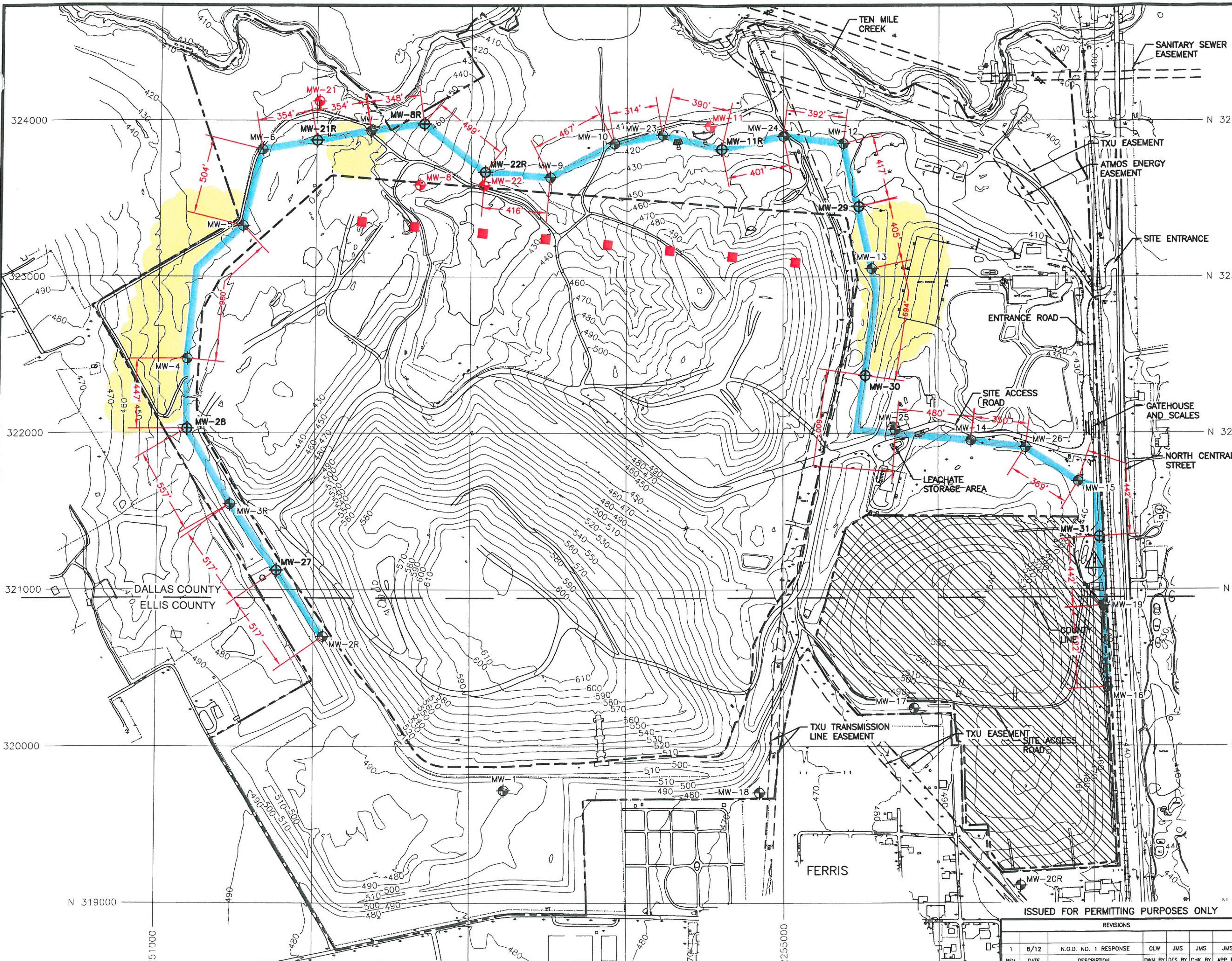
APPENDIX F1

Skyline Landfill
Monitor Well Water Level Elevations Compared with Nearby Original Piezometer Water Level Elevation



M:\Proj\101\01\120\P\Groundwater Elevation Graph.xls

Figure F1-1



0 300 600
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LANDFILL FOOTPRINT
- 410 EXISTING 10' GROUND CONTOUR
- MW-5 EXISTING MONITORING WELL
- MW-11 EXISTING MONITORING WELL TO BE PLUGGED
- MW-11R PROPOSED MONITOIRING WELL
- PROPOSED POINT OF COMPLIANCE (POC)
- GROUNDWATER ABSENT
- APPROXIMATE SUMP LOCATION
- PRE-SUBTITLE D AREA WITH FINAL COVER

NOTES:

1. MONITORING WELL LOCATION MAP MODIFIED FROM ORIGINAL HDR DRAWING.
2. EXISTING CONTOURS COMPILED BY AEROMETRIC FROM AERIAL PHOTOGRAPHY, FLOWN MARCH 6, 2011. COORDINATE INFORMATION IS BASED ON TEXAS STATE PLANE NAD 27, TEXAS NORTH CENTRAL ZONE, US FEET.

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ISSUED FOR PERMITTING PURPOSES ONLY

PROPOSED GROUNDWATER MONITORING SYSTEM

WASTE MANAGEMENT OF TEXAS, INC.
SKYLINE LANDFILL
MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256 TBPG FIRM NO. 50222

REVISIONS						
1	8/12	N.O.D. NO. 1 RESPONSE	GLW	JMS	JMS	JMS
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

DSN. ESF	DATE : 04/12	FIGURE
DWN. SRC	SCALE : GRAPHIC	F1-3
CHK. JMS	DWG : F1-3_PropGWSys.dwg	

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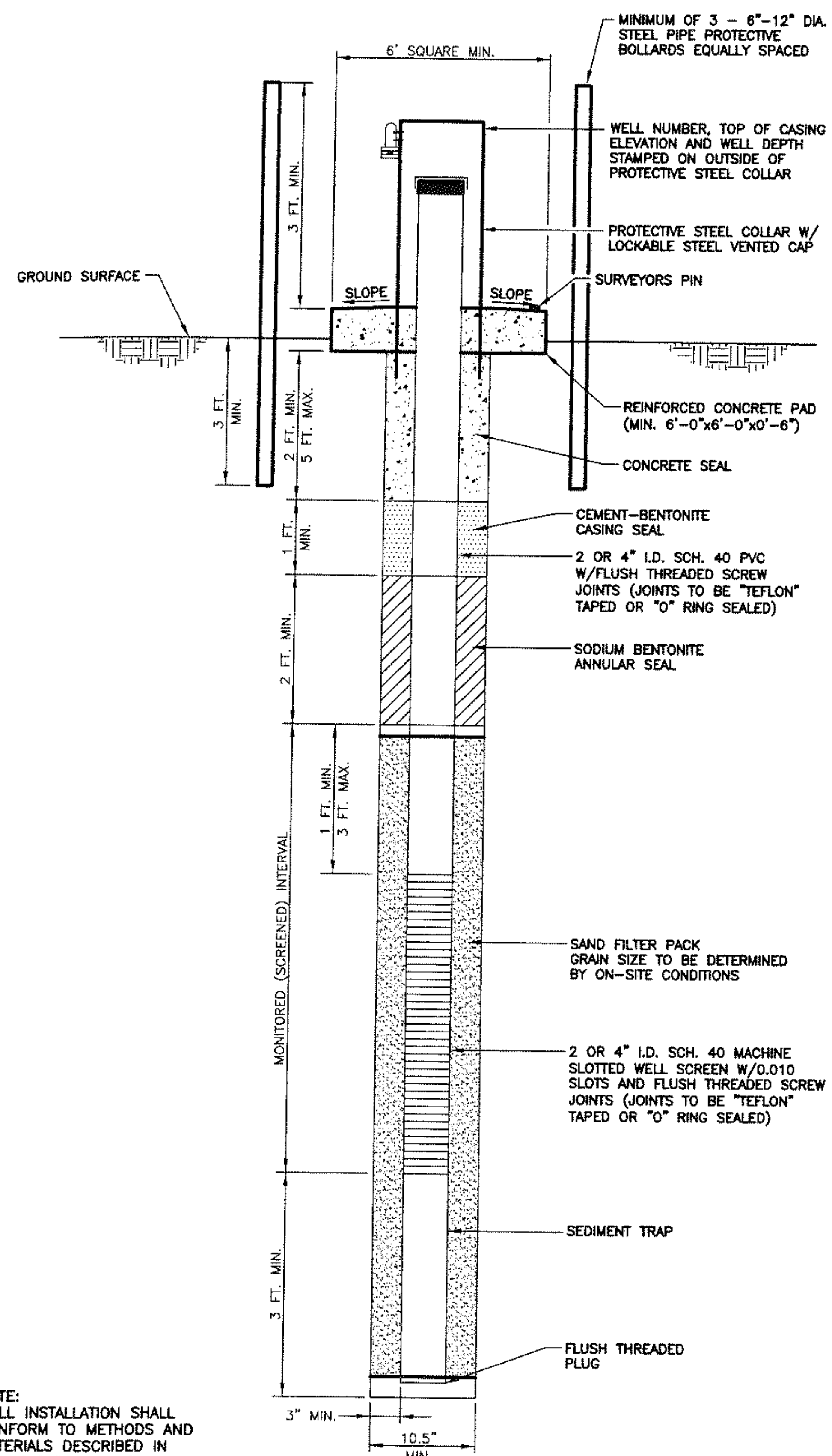

NOTE:
WELL INSTALLATION SHALL CONFORM TO METHODS AND MATERIALS DESCRIBED IN APPLICABLE REGULATIONS OF TCEQ.

TYPICAL MONITORING WELL INSTALLATION

NOT TO SCALE

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TYPICAL MONITORING WELL INSTALLATION

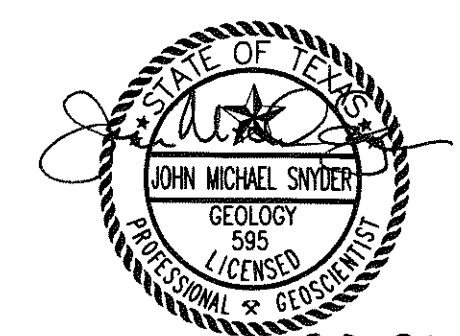
MONITORING WELL NO.	NORTHING	EASTING	GROUND ELEVATION (ft msl)	TOTAL DEPTH (ft bgs)	TOP OF CASING ELEVATION (ft msl)	SCREENED INTERVAL (ft)		FILTER PACK INTERVAL (ft)	
						FROM	TO	FROM	TO
MW-1	319720.13	2253216.98	502.57	55.0	506.63	32.0	55.0	30.0	55.0
MW-2R	320701.90	2252061.00	494.04	77.0	497.24	55.0	76.0	52.0	77.0
MW-3R	321546.48	2251466.19	473.63	63.0	476.69	41.0	62.0	38.0	63.0
MW-4	322475.59	2251185.93	433.82	25.0	437.00	7.0	25.0	5.0	25.0
MW-5	323325.95	2251534.93	421.92	32.0	425.14	7.0	32.0	5.0	32.0
MW-6	323815.10	2251655.05	416.81	25.0	419.96	7.0	25.0	5.0	25.0
MW-7	323934.73	2252352.96	429.73	25.0	432.67	7.0	25.0	5.0	25.0
MW-8R*	323890	2252698	453	25.0	455.5	25	15	25	13
MW-9	323636.73	2252503.70	418.19	38.0	421.64	15.0	38.0	13.0	38.0
MW-10	323581.93	2253918.94	415.30	49.0	417.53	26.0	49.0	23.5	49.0
MW-11R*	323820	2254607	425	30	427.5	30	20	30	18
MW-12	323853.99	2255389.37	417.83	22.0	420.95	7.0	22.0	5.0	22.0
MW-13	323053.52	2255575.75	432.23	25.0	435.22	7.0	25.0	5.0	25.0
MW-14	321954.21	2256209.38	463.51	32.5	466.71	10.0	32.5	8.0	32.5
MW-15	321692.30	2256899.70	448.66	25.5	452.20	8.0	25.5	6.0	25.5
MW-16	320374.94	2257092.88	446.36	24.5	449.56	7.0	24.5	5.0	24.5
MW-17	320243.51	2255846.00	489.85	57.5	492.75	35.0	57.5	33.0	57.5
MW-18	319705.86	2254847.83	467.00	47.5	470.20	25.0	47.5	23.0	47.5
MW-19	320896.00	2257066.39	441.25	31.0	444.45	8.5	31.0	7.0	31.0
MW-20R	319111.55	2256521.81	464.63	35.5	468.03	14.5	34.5	12.0	35.5
MW-21R*	323875	2252004	432	45	434.5	45	35	45	33
MW-22R*	323671	2253089	420	45	422.5	45	35	45	33
MW-23	323909.56	2254227.25	416.73	35.0	419.46	22.0	32.0	20.0	35.0
MW-24	323900.57	2254999.99	421.58	20.0	424.62	12.0	17.0	9.0	20.0
MW-25	322003.60	2255731.52	459.53	35.0	462.33	22.0	32.0	20.0	35.0
MW-26	321823.26	2256554.54	448.09	20.0	451.06	12.0	17.0	10.0	20.0
MW-27	321124.19	2251763.60	478.00	60.0	480.50	50.0	60.0	48.0	60.0
MW-28	322028.96	2251187.77	444	30	447.5	20	30	28	30
MW-29	323449.79	2255490.24	430	30	432.5	20	30	28	30
MW-30	322369.36	2255533.98	432	25	434.5	15	25	13	25
MW-31	321337.06	2257038.91	436.5	25	438	15	25	13	25

* DEPTHS ARE ESTIMATES ONLY. ACTUAL TOTAL DEPTH, SCREEN INTERVAL AND FILTER PACK DEPTHS WILL BE DETERMINED DURING INSTALLATION BASED ON FIELD OBSERVATIONS.

1. ALL INFORMATION SHOWN IN THIS TABLE IS APPROXIMATE AND BASED ON CURRETNLY AVAILABLE INFORMATION.

NOTES:

1. MONITORING WELLS SHALL BE DRILLED BY A TEXAS-LICENSED DRILLER WHO IS QUALIFIED TO DRILL AND INSTALL MONITORING WELLS.
2. THE WELL SHALL BE DRILLED BY A METHOD WHICH WILL ALLOW INSTALLATION OF THE CASING, SCREEN, ETC., AND THAT WILL NOT INTRODUCE CONTAMINANTS INTO THE BOREHOLE OR CASING. IF ANY FLUIDS ARE NECESSARY IN DRILLING OR INSTALLATION, THEN CLEAN, TREATED CITY WATER SHALL BE USED; OTHER FLUIDS MUST BE APPROVED IN WRITING.
3. DURING DRILLING OF THE MONITORING WELL, A LOG OF THE BORING SHALL BE MADE BY A QUALIFIED GEOLOGIST OR ENGINEER WHO IS FAMILIAR WITH THE GEOLOGY OF THE AREA.
4. THE WELL CASING SHALL BE NSF-CERTIFIED PVC SCHEDULE 40 OR 80 PIPE. FLUSH-THREAD, SCREW JOINT (NO GLUE OR SOLVENTS); POLYTETRAFLUORETHYLENE (PTFE, SUCH AS TEFLON) TAPE OR O-RINGS IN THE JOINTS; NO COLLAR COUPLINGS. THE CASING SHALL BE CLEANED AND PACKAGED AT THE PLACE OF MANUFACTURE; THE PACKAGING SHALL INCLUDE A PVC WRAPPING ON EACH SECTION OF CASING TO KEEP IT FROM BEING CONTAMINATED PRIOR TO INSTALLATION. THE CASING SHALL BE FREE OF INK, LABELS, OR OTHER MARKINGS. MANUFACTURE: THE PACKAGING SHALL INCLUDE A PVC WRAPPNG ON EACH.
5. THE SCREEN SHALL BE COMPATIBLE WITH THE CASING AND SHOULD GENERALLY BE OF THE SAME MATERIAL. THE SCREEN SHALL NOT INVOLVE THE USE OF ANY GLUES OR SOLVENTS FOR CONSTRUCTION. FIELD-CUTS SLOTS ARE NOT PERMITTED FOR WELL SCREEN. FILTER CLOTH SHALL NOT BE USED. SCREEN STERILIZATION METHODS ARE THE SAME AS THOSE FOR CASING. SELECTION OF THE SIZE OF THE SCREEN OPENING SHOULD BE DONE BY A PERSON EXPERIENCED WITH SUCH WORK.
6. THE FILTER PACK, PLACED BETWEEN THE SCREEN AND THE WELL BORE, SHALL CONSIST OF PRE-PACKAGED, INERT, CLEAN SILICA SAND OR GLASS BEADS. THE FILTER PACK SHOULD BE PLACED WITH A TREMIE PIPE TO ENSURE THAT THE MATERIAL COMPLETELY SURROUNDS THE SCREEN AND CASING WITHOUT BRIDGING. THE TREMIE PIPE SHALL BE STEAM CLEANED PRIOR TO THE FIRST WELL AND BEFORE EACH SUBSEQUENT WELL.
7. THE ANNULAR SEAL SHALL BE PLACED ON TOP OF THE FILTER PACK. THE SEAL SHOULD BE COMPOSED OF, IN ORDER OF PREFERENCE, COARSE-GRAIN SODIUM BENTONITE, COARSE-GRIT SODIUM BENTONITE, OR BENTONITE GROUT. SPECIAL CARE SHOULD BE TAKEN TO ENSURE THAT FINE MATERIAL OR GROUT DOES NOT PLUG THE UNDERLYING FILTER PACK. THE SEAL SHOULD BE PLACED ON TOP OF THE FILTER PACK WITH A STEAM-CLEANED TREMIE PIPE TO ENSURE GOOD DISTRIBUTION AND SHOULD BE TAMPED WITH A STEAM-CLEANED ROD TO DETERMINE THAT THE SEAL IS THICK ENOUGH. THE BENTONITE SHALL BE HYDRATED WITH CLEAN WATER PRIOR TO ANY FURTHER ACTIVITIES ON THE WELL AND LEFT TO STAND UNTIL HYDRATION IS COMPLETE (EIGHT TO 12 HOURS, DEPENDING ON THE GRAIN SIZE OF THE BENTONITE). IF A BENTONITE-GROUT (WITHOUT CEMENT) CASING SEAL IS USED IN THE WELL BORE, THEN IT MAY REPLACE THE ANNULAR SEAL DESCRIBED ABOVE.
8. A CASING SEAL SHALL BE PLACED ON TOP OF THE ANNULAR SEAL TO PREVENT FLUIDS AND CONTAMINANTS FROM ENTERING THE BOREHOLE FROM THE SURFACE. THE CASING SEAL SHALL CONSIST OF A COMMERCIAL BENTONITE GROUT OR A CEMENT-BENTONITE MIXTURE.
9. CONCRETE PAD. HIGH-QUALITY STRUCTURAL-TYPE CONCRETE SHALL BE PLACED FROM THE TOP OF THE CASING SEAL (TWO TO FIVE FEET BELOW THE SURFACE) CONTINUOUSLY TO THE TOP OF THE GROUND TO FORM A PAD AT THE SURFACE. THIS FORMED SURFACE PAD SHALL BE AT LEAST SIX INCHES THICK. THE TOP OF THE PAD SHALL SLOPE AWAY FROM THE WELL BORE TO THE EDGES TO PREVENT PONDING OF WATER AROUND THE CASING OR COLLAR.
10. A STEEL PROTECTIVE PIPE COLLAR SHALL BE PLACED AROUND THE CASING "STICKUP" TO PROTECT IT FROM DAMAGE AND UNWANTED ENTRY. THE TOP OF THE COLLAR SHALL HAVE A LOCKABLE HINGED TOP FLAP OR COVER. A STURDY LOCK SHALL BE INSTALLED, MAINTAINED IN WORKING ORDER, AND KEPT LOCKED WHEN THE WELL IS NOT BEING BAILED/PURGED OR SAMPLED. THE WELL NUMBER OR OTHER DESIGNATION SHALL BE MARKED PERMANENTLY ON THE PROTECTIVE STEEL COLLAR.
11. SEDIMENT TRAP APPROXIMATELY 6 INCHES IN MW-2R AND 3R.



8-21-2012

ISSUED FOR PERMITTING PURPOSES ONLY

REVISIONS						
1	8/12	N.O.D. NO. 1 RESPONSE	GLW	JMS	JMS	JMS
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

MONITORING WELL DETAIL

WASTE MANAGEMENT OF TEXAS, INC.
SKYLINE LANDFILL
MAJOR PERMIT AMENDMENT

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256 TBPG FIRM NO. 50222

DSN. ESF	DATE : 04/12	FIGURE
DWN. SRC	SCALE : GRAPHIC	
CHK. JMS	DWG : F1-4_MW_Detail.dwg	F1-4

SKYLINE LANDFILL
CITY OF FERRIS
DALLAS AND ELLIS COUNTIES, TEXAS
TCEQ PERMIT APPLICATION NO. MSW 42D

PERMIT AMENDMENT APPLICATION

PART III – FACILITY INVESTIGATION AND DESIGN
APPENDIX F2
GROUNDWATER SAMPLING AND ANALYSIS PLAN

Prepared for

Waste Management of Texas, Inc.

April 2012

Revised August 2012

STATE OF TEXAS
JOHN MICHAEL SNYDER
GEOLOGY
595
LICENSED
PROFESSIONAL GEOSCIENTIST

8-21-2012

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TEXAS BOARD OF PROFESSIONAL ENGINEERS
FIRM REGISTRATION NO. F-256

TEXAS BOARD OF PROFESSIONAL GEOSCIENTISTS
FIRM REGISTRATION NO. 50222

CONTENTS

maintained during shipment. All samples included in the cooler will be packed in such a manner to minimize the potential for container breakage. Volatile Organic Analysis (VOA) vials and toxicology (TOX) bottles will not be placed directly on the ice packs (or ice). A Field Information Form (Figure 2-1) and Chain of Custody Form (Figure 2-2) will be sealed in a water resistant bag and placed with the appropriate sample bottle set.

2.4.1 Chain of Custody

Appropriate Chain of Custody procedures for samples will be implemented to ensure sample integrity and to provide technically and legally defensible groundwater quality data. At the time each sample is collected, Chain-of-Custody (Figure 2-2) and Field Information Forms (Figure 2-1) will be completed and placed in the cooler. The Field Information form will include general sampling event information including location, time, weather conditions, sampler identification, well integrity, any numerical field data values, and well purging procedures. The cooler will then be sealed with a tamper-proof lock and the custody seal provided with the cooler.

Upon arrival of the cooler at the laboratory, the cooler will be opened and the Chain of Custody forms will be signed and time/dated by the person taking custody of the cooler. The Bill of Lading or receipt for cooler shipment will be attached to the Chain of Custody form upon arrival at the analytical laboratory.

Chain of Custody Record

STL-4124 (0700)

Client	Project Manager	Date	Chain of Custody Number
Address	Telephone Number (Area Code)/Fax Number	Lab Number	
City / State / Zip Code	Site Contact / Lab Contact		Page ____ of ____
Project Name and Location (State)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed)	Special Instructions/ Conditions of Receipt

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By			1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy