APPENDIX G

Water Quality Monitoring Program for the Trail Ridge Landfill, Phases 6-14 Class I Cell Expansion

City of Jacksonville, Florida

July 2013

CDM Smith

DRAFT

Table of Contents

Tables

Figures

Appendix G

Water Quality Monitoring Program for the Trail Ridge Landfill, Phases 6-14 Class I Cell Expansion

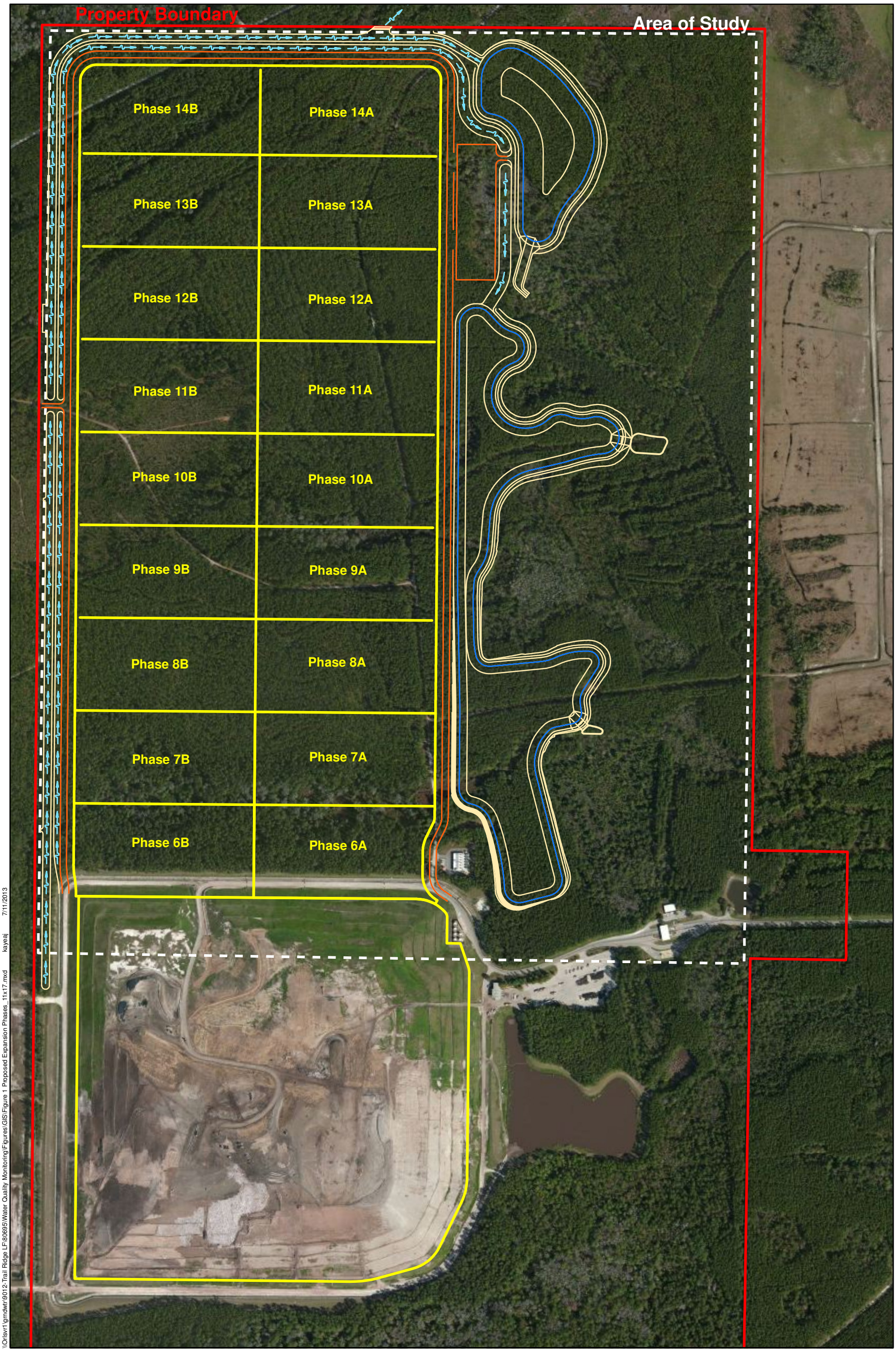
1.0 Introduction and Background

Trail Ridge Landfill is a Class I landfill that is owned by the City of Jacksonville, Florida (City) and operated by Trail Ridge Landfill, Inc. (a Waste Management Company). The types of waste accepted at Trail Ridge Landfill typically consist of residential/household, office, commercial, agricultural, and industrial wastes. The site serves the City of Jacksonville, Duval County, and Northeast Florida. Based on facility waste records, the annual tonnage for 2010 was approximately 710,012 tons.

The landfill property is located along the central-western border of Duval County, in Sections 18 through 21, Township 3 South, Range 23 East. The total land area is approximately 978 acres, of which approximately 148 acres are used as part of the existing cell area. The existing cell area has been developed via five stages of cell construction over 20 years and is within 5 to 7 years of completion. As part of the Trail Ridge Landfill Master Site Plan Report, CDM Smith evaluated various build-out options of the site to increase the capacity of the landfill. **Figure 1** shows the proposed extents of each expansion (Phases 6 through 14) located to the North of the existing landfill. In addition, the proposed stormwater management system is shown on Figure 1.

To support design and permitting of future expansion phases, CDM Smith developed a groundwater quality and surface water quality monitoring plan in accordance with water quality monitoring requirements for solid waste management facilities described in Section 62-701.510, Florida Administrative Code (FAC) and Chapter 62-520, FAC. The following items are included in this Water Quality Monitoring Program summary:

- Details of the groundwater monitoring system;
- Details of the surface water monitoring system;
- Sampling frequency and requirements for the water quality monitoring program; and
- Water quality monitoring reporting requirements.



\\Orlsvr1\gmdwtr\9012-Trail Ridge LF\80695\Water Quality Monitoring\Figures\GIS\Figure 1 Proposed Expansion Phases_11x17.mxd kayeaj 7/11/2013

Legend

- Landfill Cell Expansion Phases
- Ditch Flow Direction
- Perimeter Road
- Normal Water Surface Level
- Proposed Pond Configuration
- Property Boundary

DRAFT

Figure 1
Location of Proposed Landfill Expansion Phases
Trail Ridge Landfill
Duval County, Florida

N W E S

0 300 600 Feet

CDM Smith

2.0 Water Quality Monitoring Program

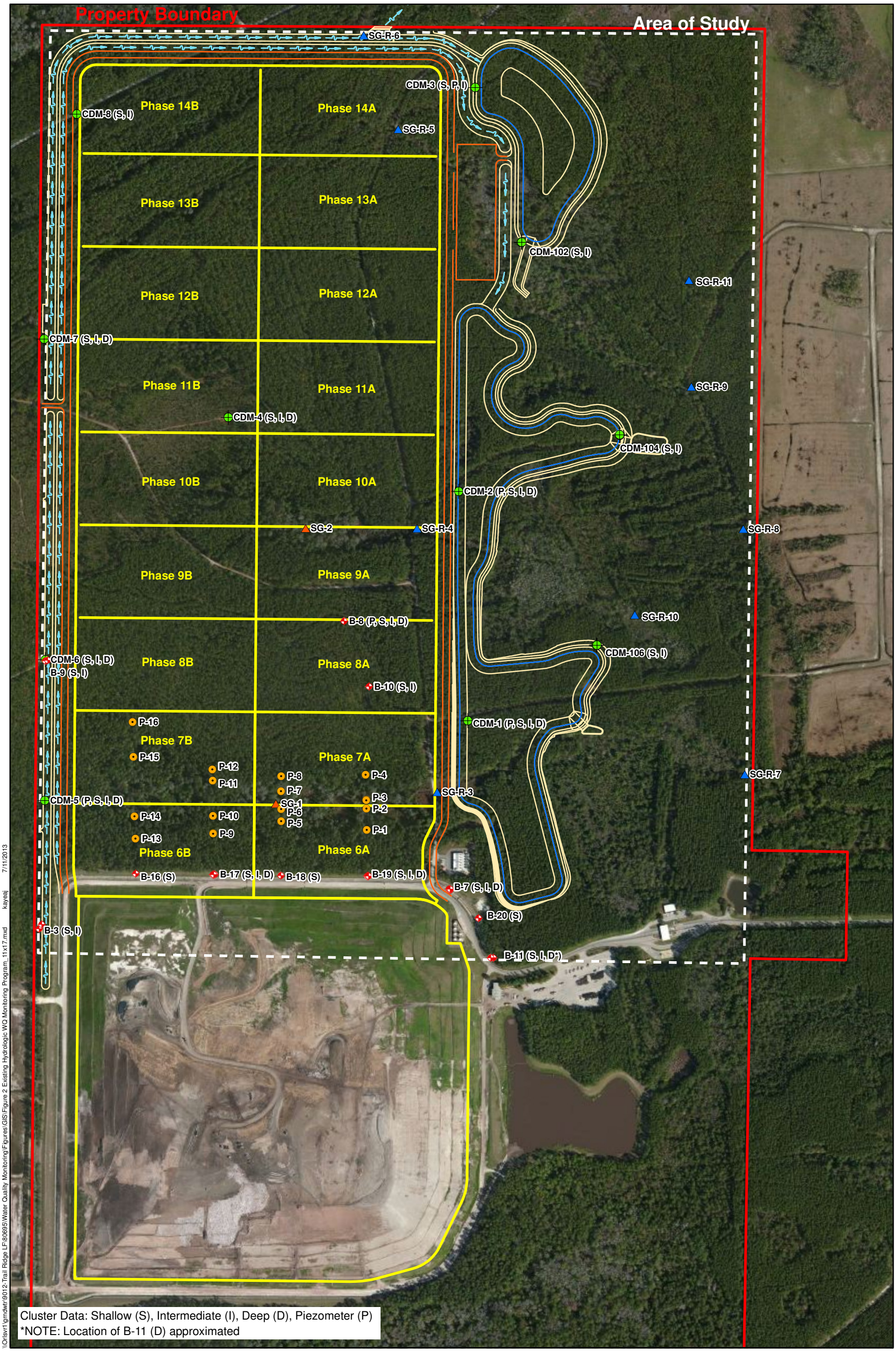
The groundwater and surface water quality monitoring program for the Trail Ridge Landfill proposed expansion area was developed in accordance with water quality monitoring requirements for solid waste management facilities described in Section 62-701.510, FAC and Section 62-520.600, FAC. The program is based on the site hydrogeology and surface water flow patterns described in the *Hydrogeologic Summary and Background Monitoring Report for the Trail Ridge Landfill, Phases 6-14 Class I Cell Expansion* (Appendix P), the monitoring program for the existing landfill, the landfill expansion design and the minimum requirements contained in Section 62-701.510, FAC.

2.1 Groundwater Monitoring System

The groundwater monitoring program has been designed to detect and monitor adverse impacts to the groundwater system by facility activities at the proposed expansion area. The program includes a groundwater monitoring network for the surficial aquifer system, which is classified as a Class G-II groundwater source, as defined in Section 62-520.410 FAC. As described in the Hydrogeologic Summary and Background Monitoring Report, there are two distinct units that make up the surficial aquifer system at the Trail Ridge Landfill site. In order of increasing depth, these include: the water table unit (40 to 130 feet thick), which consists of sand and slightly silty sand and the limestone unit (0 to25 feet thick). The limestone unit is not continuous across the site. Between these two aquifer units, there is a semi-confining zone of low permeability sediments comprised of clay, clayey sand and silty sand, which is not continuous across the site. Where present, the semi-confining unit ranges in thickness from 6 to 45 feet. As described in the Hydrogeologic Summary and Background Monitoring Report, the horizontal groundwater flow direction in both surficial aquifer units at the expansion area was toward the northeast, from a groundwater high located at the southwest corner of the proposed expansion area.

The background groundwater monitor well network, described in the Hydrogeologic Summary and Background Monitoring Report, consists of monitor wells installed to three different depths generally described as shallow, intermediate and deep. The shallow monitor wells are installed to depths ranging from 10 to 30 feet bls representative of the uppermost portion of the water table unit of the surficial aquifer system. The intermediate (depth) monitor wells are installed to depths ranging from 40 to 65 feet bls representative of the middle to lower portion of the water table unit of the surficial aquifer system. The deep monitor wells are installed to depths ranging from 100 to 110 feet bls representative of the limestone unit of the surficial aquifer system.

In support of the background hydrologic and water quality monitoring plan, 32 monitor wells and piezometers (designated with "CDM" as the prefix) were installed in and around the proposed expansion area as shown on **Figure 2**. In addition, 23 existing Waste Management monitor wells (designated with "B" as the prefix) were utilized in the background hydrologic monitoring. In support of geotechnical investigations, described in the *Trail Ridge Landfill Expansion Geotechnical Report* (CDM Smith, 2012) (Attachment F-1), 16 shallow piezometers (designated as P-1 through P-16) were installed around wetland ditch B in the expansion area Phases 6 and 7 to evaluate hydraulic gradients and water table elevations in this wetland. Based on the proposed site layout shown on Figure 2, the majority of the monitor wells and piezometers will need to be abandoned since they are located in areas planned for construction of the landfill or within the footprint of the stormwater management system. Existing CDM Smith installed monitor well cluster CDM-7 located along the western perimeter of the landfill expansion area, are the only existing monitor wells which will be maintained. The CDM-7 cluster will be utilized as background monitor wells, as discussed in subsection 2.1.1.



\\Orlsvr1\gmdwtr\9012-Trail Ridge LF\80695\Water Quality Monitoring\Figures\GIS\Figure 2 Existing Hydrologic WQ Monitoring Program_11x17.mxd kayeaj 7/11/2013

Legend

- Staff Gauge Only
- Staff Gauge with Data
- Logger Recorder in Stilling Well
- Monitor Well Cluster
- Waste Management Monitor Well Cluster Used in Background Evaluation
- Hand Auger and Shallow Piezometers
- Ditch Flow Direction
- Perimeter Road
- Normal Water Surface Level
- Proposed Pond Configuration
- Property Boundary

DRAFT

N W E S

0 300 600 Feet

CDM Smith

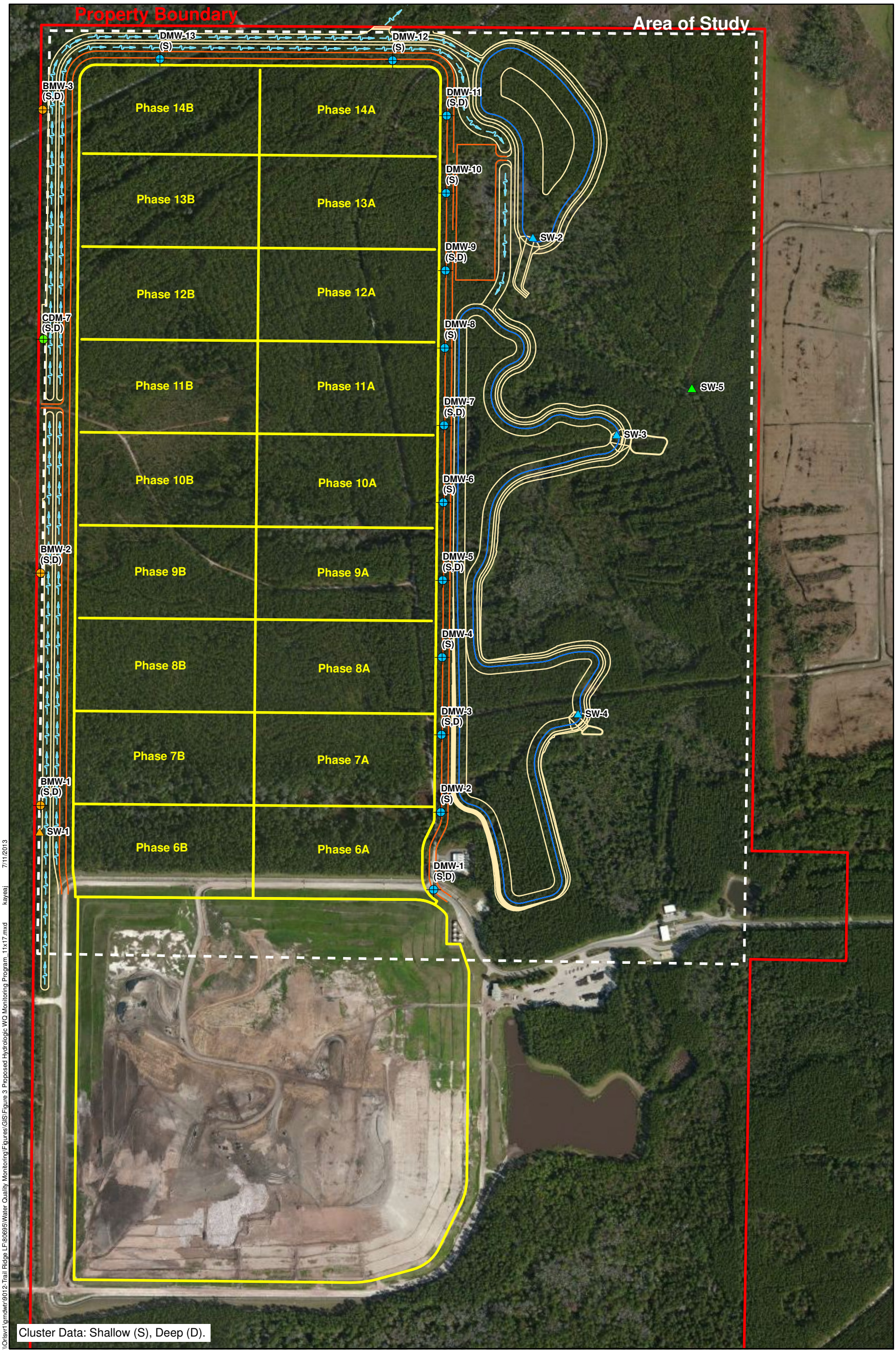
Figure 2
Existing Hydrologic and Water Quality Monitoring Network
Trail Ridge Landfill
Duval County, Florida

Other existing Waste Management monitor well clusters (B-3, B-7, B-20, and B-11 will be maintained, but will not be utilized in the groundwater monitoring system of the expansion area.

The proposed groundwater detection monitoring program for the expansion area includes a total of 8 background monitor wells and 19 detection monitor wells shown on **Figure 3**. A summary of the well construction information, including estimated well depth and screen interval, for the proposed groundwater monitoring network is provided in a **Table 1**. The actual well depth and screen interval will be determined during well installation based on site specific boring log information. The 8 background wells, two existing wells (CDM-7S and CDM-7D) and six new wells (designated BMW) installed in three clusters of shallow and deep wells will monitor groundwater along the western boundary of the site. Nineteen new detection monitor wells (designated DMW) will be installed along eastern and northern side of the landfill expansion area. Shallow detection monitor wells will be installed at 13 locations. Deep detection monitor wells will also be installed at 6 of the well locations. The new background and detection monitor wells will be installed as the expansion area phases are developed as indicated in Table 1. For example, proposed monitor wells associated with Phases 9 through 14 will not be installed until those Phases are developed. **Figure 4** and **Figure 5** show typical well construction details for the proposed shallow and deep monitor wells, respectively. **Figure 6** shows a typical monitor well cluster installation with one shallow monitor well and one deep monitor well.

Following installation, the location (latitude and longitude) of each well, the elevation of the top of the well casing, and the ground surface elevation at each well location will be determined by a Professional Surveyor and Mapper registered in the State of Florida using horizontal and vertical control. A map showing the locations, top of casing elevation, and ground surface elevation of monitor wells as well as top of casing elevation and ground surface elevation will be submitted to FDEP within 60 days of well installation in accordance with Section 62-520.600(6)(i), FAC. In addition, Monitor Well Completion Reports containing the details of the monitor well construction information and soil boring/lithologic logs will be submitted to FDEP within 30 days of well installation in accordance with Section 62-520.600(6)(j), FAC.

Pursuant to Rule 62-520.465(2)(a), the zone of discharge will be limited horizontally to 100 feet from the proposed disposal unit, or to the property boundary, or the shortest distance between the compliance wells (when installed) and the proposed disposal unit, whichever is less. It is common in FDEP permits that the zone of discharge also extends vertically 100 feet or to the base of the surficial aquifer, whichever is shallower. From discussions with Mike Dunaway and Drew Robertson with FDEP, some monitor wells will need to be installed to a sufficient depth to comply with this requirement. Drinking water quality criteria (as described in Chapter 62-550, FAC) will have to be met at the edge of the zone of discharge for the expansion area since groundwater in the surficial aquifer system is classified as G-II. The edge of the zone of discharge (100 feet) becomes the point of compliance. Detection monitor wells should be installed approximately halfway between the edge of the waste unit and the point of compliance.



\\Orlsvr1\gmdwtr\9012-Trail Ridge LF\80695\Water Quality Monitoring\Figures\GIS\Figure 3 Proposed Hydrologic WQ Monitoring Program_11x17.mxd kayeaj 7/11/2013

Legend

- Proposed New Background Monitoring Well Cluster
- Proposed New Detection Monitoring Well Cluster
- Proposed Upgradient SW Sampling Location
- Proposed Discharge SW Sampling Location
- Proposed Downgradient SW Sampling Location
- Existing Monitoring Well Cluster
- Ditch Flow Direction
- Perimeter Road
- Normal Water Surface Level
- Proposed Pond Configuration
- Landfill Cell Expansion Phases
- Property Boundary

DRAFT

Figure 3
Proposed Hydrologic and Water Quality Monitoring Network
Trail Ridge Landfill
Duval County, Florida

N W E S

0 300 600 Feet

CDM Smith

Table 1. Proposed Groundwater Monitoring Well Network Construction Summary

Surficial Aquifer Zone	Well ID	Well Designation	Well Status	Monitored Expansion Phase	Approximate State Plane Coordinates (ft)[1,2]		Well Diameter[2]	Total Well Depth[2]	Well Screen Interval[2]
					Northing	Easting	(in)	(ft bls)	(ft bls)
Shallow	CDM-7(S)	Background	Existing	Phases 11/12	2,147,741	324,800	2	19	14 to 19
	BMW-1(S)	Background	Proposed	Phases 6/7	2,144,747	324,786	2	15	10 to 15
	BMW-2(S)	Background	Proposed	Phases 8/9/10	2,146,247	324,786	2	19	14 to 19
	BMW-3(S)	Background	Proposed	Phases 13/14	2,149,241	324,800	2	16	11 to 16
	DMW-1(S)	Detection	Proposed	Phase 6	2,144,202	327,321	2	16	11 to 16
	DMW-2(S)	Detection	Proposed	Phase 6	2,144,702	327,367	2	16	11 to 16
	DMW-3(S)	Detection	Proposed	Phase 7	2,145,202	327,371	2	16	11 to 16
	DMW-4(S)	Detection	Proposed	Phase 8	2,145,702	327,375	2	16	11 to 16
	DMW-5(S)	Detection	Proposed	Phase 9	2,146,201	327,379	2	14	9 to 14
	DMW-6(S)	Detection	Proposed	Phase 10	2,146,702	327,383	2	14	9 to 14
	DMW-7(S)	Detection	Proposed	Phase 11	2,147,202	327,388	2	14	9 to 14
	DMW-8(S)	Detection	Proposed	Phase 11	2,147,701	327,392	2	10	5 to 10
	DMW-9(S)	Detection	Proposed	Phase 12	2,148,201	327,397	2	10	5 to 10
	DMW-10(S)	Detection	Proposed	Phase 13	2,148,701	327,401	2	10	5 to 10
	DMW-11(S)	Detection	Proposed	Phase 14	2,149,201	327,405	2	16	11 to 16
	DMW-12(S)	Detection	Proposed	Phase 14	2,149,559	327,056	2	16	11 to 16
	DMW-13(S)	Detection	Proposed	Phase 14	2,149,567	325,556	2	16	11 to 16
Deep	CDM-7(D)	Background	Existing	Phases 11/12	2,147,752	324,801	2	110	100 to 110
	BMW-1(D)	Background	Proposed	Phases 6/7	2,144,747	324,786	2	111	100 to 110
	BMW-2(D)	Background	Proposed	Phases 8/9/10	2,146,247	324,786	2	110	100 to 110
	BMW-3(D)	Background	Proposed	Phases 13/14	2,149,241	324,800	2	110	100 to 110
	DMW-1(D)	Detection	Proposed	Phase 6	2,144,202	327,321	2	100	95 to 100
	DMW-3(D)	Detection	Proposed	Phases 7/8	2,145,202	327,371	2	100	95 to 100
	DMW-5(D)	Detection	Proposed	Phase 9	2,146,201	327,379	2	100	95 to 100
	DMW-7(D)	Detection	Proposed	Phases 10/11	2,147,202	327,388	2	100	95 to 100
	DWM-9(D)	Detection	Proposed	Phases 12/13	2,148,201	327,397	2	100	95 to 100
	DMW-11(D)	Detection	Proposed	Phase 14	2,149,201	327,405	2	100	95 to 100

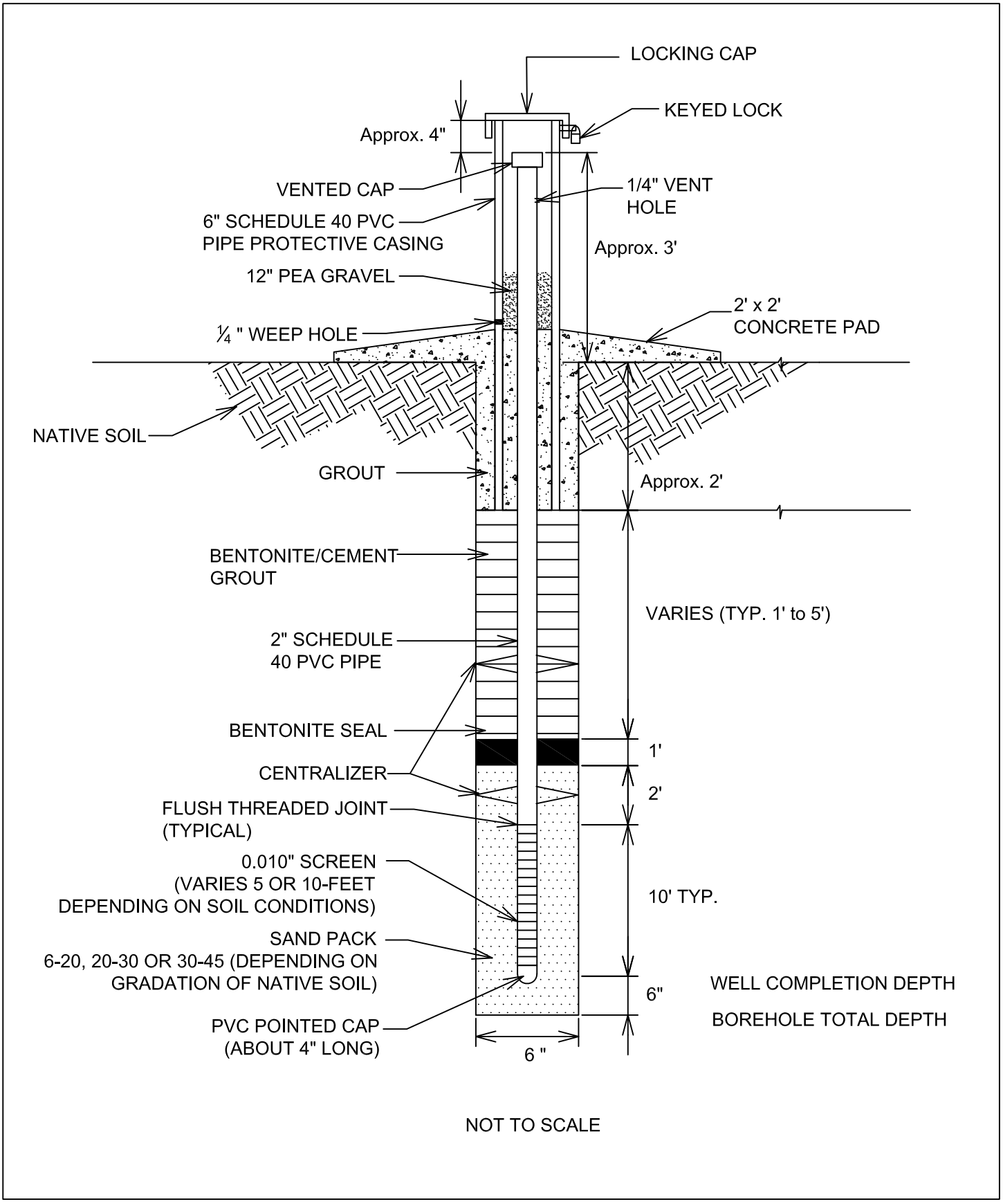
Notes:

[1] Florida State Plane Coordinate System East Zone (HARN 83)

[2] For proposed monitoring wells, the values are estimated. Actual well depth and screen interval will be determined a the time of well installation based upon a soil boring drilled at each location.

(S) - Shallow monitoring well

(D) - Deep monitoring well

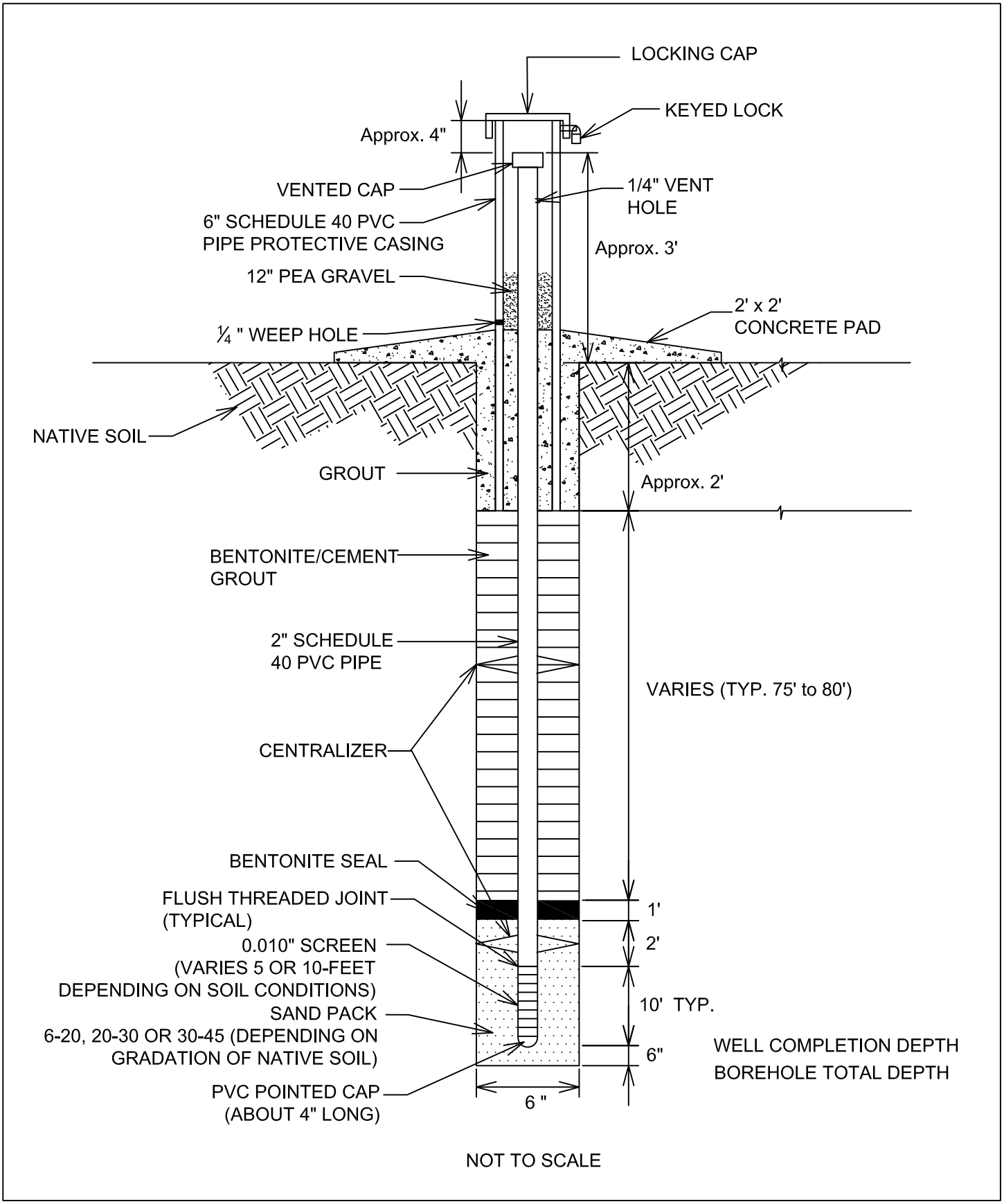


\\Orlsvr1\grndwtr\9012-Trail Ridge LF\80695\Water Quality Monitoring\Figures\AutoCAD\Fig 4 Typical 2-in Shallow MW Construction Detail.dwg

CDM Smith

DRAFT

Figure 4
Typical 2" Diameter Shallow
Monitor Well Construction Detail

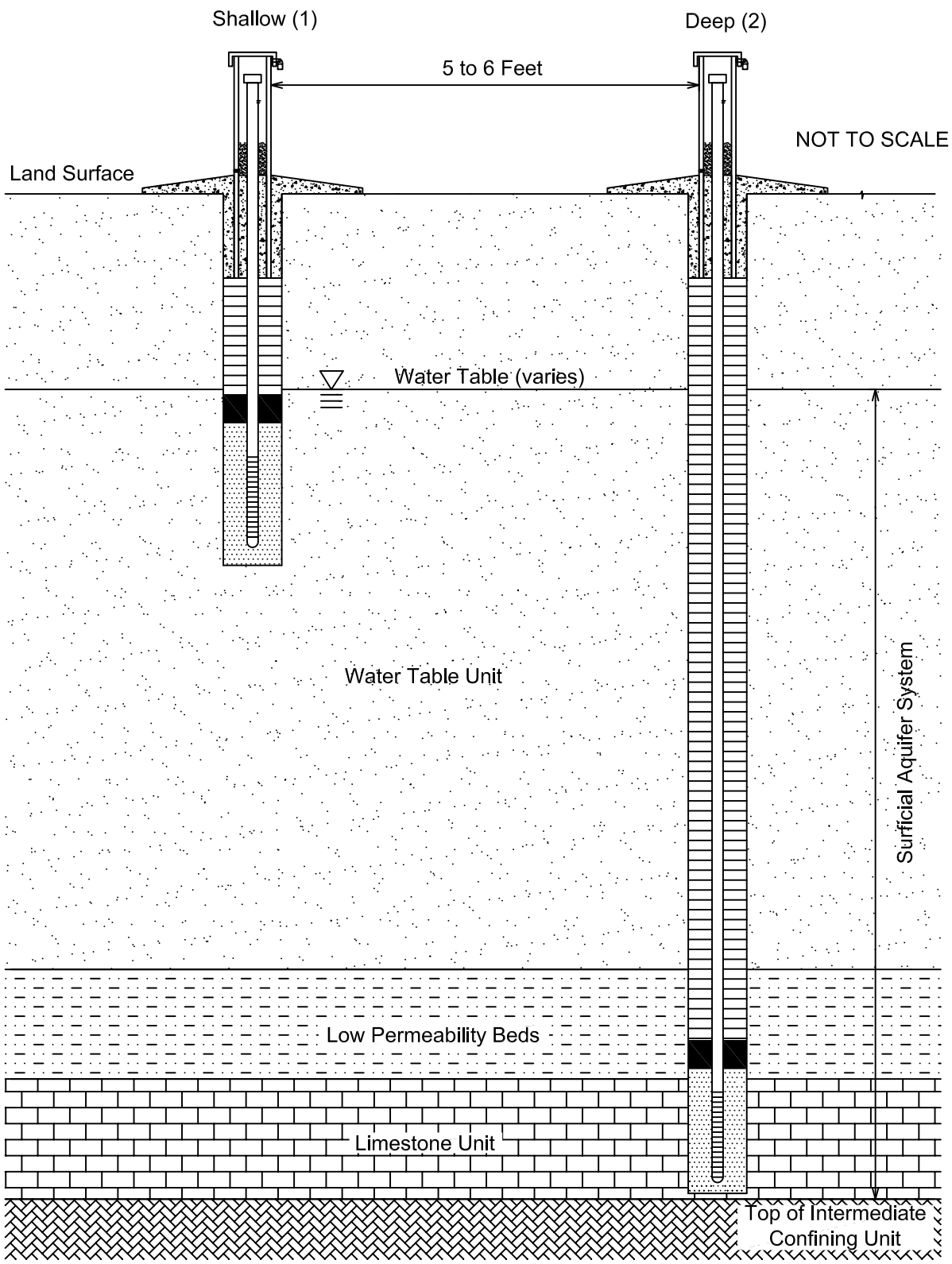


\\Orlsvr1\grndwtr\9012-Trail Ridge LF\80695\Water Quality Monitoring\Figures\AutoCAD\Fig 5 Typical 2-in Deep MW Construction Detail.dwg

CDM Smith

DRAFT

Figure 5
Typical 2" Diameter Deep
Monitor Well Construction Detail



(1) See Figure 4 for a typical detail
(2) See Figure 5 for a typical detail

\\Orlsvr1\grndwtr\9012-Trail Ridge LF\80695\Water Quality Monitoring\Figures\AutoCAD\Fig 6 Typical MW Cluster Installation.dwg

CDM Smith

Figure 6
Typical Monitor Well Cluster Installation

DRAFT

2.1.1 Background Monitor Wells

Pursuant to Section 62-701.510(3)(d)(3), FAC, the background monitor wells will be spaced no greater than 1,500 feet apart across the upgradient direction of groundwater flow. Since groundwater flows west to east across the site, all of the background wells will be installed along the western property line. As shown on Figure 3, in addition to existing monitor well cluster CDM-7, three monitor well clusters will be installed along the western perimeter of the expansion area and will serve as the upgradient background monitor wells. The upgradient wells will be located adjacent to the proposed perimeter road and approximately 200 feet upgradient of the disposal unit. As shown in Table 1, a total of 8 groundwater monitor wells will serve as background monitoring wells as follows:

- Four monitor wells (2-inch diameter) in the shallow zone of the surficial aquifer (total estimated installation depths range from 15 to 19 ft bls): CDM-7(S), BMW-1(S), BMW-2(S), and BMW-3(S).
- Four monitor wells (2-inch diameter) in the deep zone of the surficial aquifer (total estimated installation depths are 100 ft bls): CDM-7(D), BMW-1(D), BMW-2(D), and BMW-3(D).

2.1.2 Detection Monitor Wells

Pursuant to Section 62-701.510(3)(d)(3), FAC, the background monitor wells will be spaced no greater than 500 feet apart across the downgradient direction of groundwater flow. In the southern portion of the expansion areas (Phases 6 through 8) groundwater flows west to east across the site. For these Phases, it is not anticipated that detection wells would be required along the northern boundary of the landfill cell. In the northern portion of the expansion area (Phases 9 through 14), groundwater flows towards the east-northeast. For these Phases, temporary detection wells may be required along the northern boundary of the landfill cells as they are constructed.

Detection monitor wells will be installed downgradient of the expansion phase disposal units to detect the chemical and physical characteristics of the discharge plume. Detection wells will be located approximately 50 feet downgradient from the disposal unit. The downgradient detection monitor well system for the entire expansion area (Phases 6 through 14) will include thirteen well clusters (clusters DMW-1 through DMW-13) located east and north of the landfill expansion, along the western and southern shoulder of the perimeter road. As shown in Table 1, a total of 19 groundwater monitor wells will serve as detection monitor wells, as follows:

- Thirteen monitor wells (2-inch diameter) in the shallow zone of the surficial aquifer (total estimated installation depths range from 10 to 16 ft bls): DMW-1(S) through DMW-13(S).
- Six monitor wells (2-inch diameter) in the deep zone of the surficial aquifer (total estimated installation depths are 100 ft bls): DMW-1(D), DMW-3(D), DMW-5(D), DMW-7(D), DMW-9(D), and DMW-11(D)

2.1.3 Compliance Monitor Wells

If evaluation monitoring is required due to conditions described in Section 62-701.510(6), FAC, such as exceedance of applicable water quality standards in detection monitor wells, compliance well(s) downgradient from the affected detection monitor wells will be installed and sampled within 90 days of notification from FDEP. If necessary, compliance monitor wells will be used to monitor for any discharge above applicable water quality standards beyond the zone of discharge. Since the compliance wells will only be installed if required by FDEP, the exact number, location, and screened depth are not known. If necessary, the proposed compliance monitor well(s) will be located along the

"line of compliance" along the northern and eastern shoulder of the perimeter road.. The "line of compliance" is approximately 90 feet downgradient from the disposal unit, near the edge of the zone of discharge, and approximately 40 feet downgradient from the detection monitor well(s). Compliance wells, if required, would be spaced no more than 500 feet apart along the "line of compliance".

2.1.4 Well Abandonment

A summary of the existing monitoring wells, piezometers, and surface water staff gauges, which will be abandoned as part of the Phase 6 and Phase 7 expansion is provided in **Table 2**. These monitor wells, piezometers, and staff gauges are located in areas where landfill construction activities will occur as part of the Phase 6 and Phase 7 expansion, including the construction of the perimeter road, by-pass ditch, and two stormwater ponds. A total of 43 existing monitor wells and piezometers installed by CDM Smith will be abandoned as part of the landfill expansion. An additional 10 existing Waste Management monitor wells located north of the existing landfill will also be abandoned as part of the landfill expansion. Three staff gauges installed by CDM Smith will also be abandoned.

Monitor wells and piezometers which are located inside the landfill expansion Phases 6 and 7 (monitor well clusters B-16 through B-19 and piezometers P-1 through P-16) will be abandoned in such a way as to prevent potential puncture and failure of the landfill liner when the landfill liner settles over time. From the Geotechnical Evaluation report (Appendix F) for the landfill, the maximum liner settlement predicted for Phases 6 and 7 is 33 inches. Intermediate and deep monitor wells, which range in depths from approximately 55 to 125 feet below land surface (bls), will be cut off a minimum of 6 feet below the final grade of the landfill base (more than twice the predicted maximum settlement) and grouted from the bottom of well/piezometer to the top. The shallow monitor wells and piezometers, which range in depths of 5 to 18 feet bls, will be abandoned by pulling the monitor well or piezometer out of the ground, if possible. If any shallow zone monitor well or piezometers cannot be removed by this method, they will be abandoned in the same manner as the intermediate and deep zone monitor wells. Other monitor wells and piezometers which will be abandoned due to the construction of the perimeter road, ditches, and ponds, will be properly abandoned in accordance with requirements in *Guidance for Ground Water Monitoring Plan Design*, (FDEP, 2008) and rules developed by the State of Florida (Chapter 40C-3, FAC).

2.2 Surface Water Monitoring System

The existing surface water flow in the undeveloped expansion area follows the general topography of the area, and flows towards the east. As shown on Figure 3, the proposed expansion plan and surface water management features include the construction of two ponds east of the expansion area and two water conveyance ditches. In accordance with Section 62-701.510(4), FAC, all surface water bodies that may be affected by a contaminant release from the landfill will be monitored.

To control the surface water flow onto the site along the west and north boundaries of the site, the proposed expansion plan includes the construction of an offsite bypass ditch which will collect surface water flow upgradient of the expansion area and route it along the northern perimeter to a bypass pond, which will be constructed near the northeast corner of the expansion area. The bypass pond will then discharge to the offsite wetlands east of the expansion area.

Table 2. Summary of Existing Monitor Wells, Piezometers, and Staff Gauges to be Abandoned During Phase 6 and 7 Construction

Monitored Zone	Well/Station ID	Type	Operated By	State Plane Coordinates (ft) [1]		Well Depth (ft bls)
				Northing	Easting	
Surface Water	SG-1	Staff Gauge	CDM Smith	2,144,761	326,305	NA
	SG-R-3	Staff Gauge	CDM Smith	2,144,837	327,384	NA
	SG-R-6	Staff Gauge	CDM Smith	2,149,667	326,876	NA
Shallow Zone of Surficial Aquifer	B-9S	Monitor Well	Waste Management Inc.	2,145,687	324,786	-
	B-16S	Monitor Well	Waste Management Inc.	2,144,299	325,395	17.5
	B-17S	Monitor Well	Waste Management Inc.	2,144,295	325,906	16.1
	B-18S	Monitor Well	Waste Management Inc.	2,144,289	326,333	16.5
	B-19S	Monitor Well	Waste Management Inc.	2,144,284	326,888	18.0
	CDM-1P	Piezometer	CDM Smith	2,145,293	327,543	5
	CDM-1S	Monitor Well	CDM Smith	2,145,290	327,543	16
	CDM-2P	Piezometer	CDM Smith	2,146,776	327,479	5
	CDM-2S	Monitor Well	CDM Smith	2,146,773	327,482	14
	CDM-3S	Monitor Well	CDM Smith	2,149,375	327,594	16
	CDM-3P	Piezometer	CDM Smith	2,149,373	327,590	33
	CDM-5P	Piezometer	CDM Smith	2,144,775	324,814	8
	CDM-5S	Monitor Well	CDM Smith	2,144,770	324,815	15
	CDM-6S	Monitor Well	CDM Smith	2,145,669	324,818	29
	CDM-8S	Monitor Well	CDM Smith	2,149,206	325,024	16
	CDM-102S	Piezometer	CDM Smith	2,148,383	327,883	10
	CDM-104S	Piezometer	CDM Smith	2,147,135	328,520	15
	CDM-106S	Piezometer	CDM Smith	2,145,777	328,368	10
	P-1	Piezometer	CDM Smith	2,144,583	326,886	5
	P-2	Piezometer	CDM Smith	2,144,721	326,883	5
	P-3	Piezometer	CDM Smith	2,144,775	326,883	5
	P-4	Piezometer	CDM Smith	2,144,939	326,879	5
	P-5	Piezometer	CDM Smith	2,144,639	326,334	5
	P-6	Piezometer	CDM Smith	2,144,717	326,334	5
	P-7	Piezometer	CDM Smith	2,144,833	326,333	5
	P-8	Piezometer	CDM Smith	2,144,931	326,334	5
	P-9	Piezometer	CDM Smith	2,144,560	325,895	5
	P-10	Piezometer	CDM Smith	2,144,674	325,893	5
	P-11	Piezometer	CDM Smith	2,144,903	325,891	5
	P-12	Piezometer	CDM Smith	2,144,974	325,889	5
	P-13	Piezometer	CDM Smith	2,144,527	325,393	5
	P-14	Piezometer	CDM Smith	2,144,670	325,387	5
	P-15	Piezometer	CDM Smith	2,145,056	325,379	5
	P-16	Piezometer	CDM Smith	2,145,282	325,375	5
Intermediate Zone of Surficial Aquifer	B-9I	Monitor Well	Waste Management Inc.	2,145,692	324,784	-
	B-17I	Monitor Well	Waste Management Inc.	2,144,295	325,893	57.9
	B-19I	Monitor Well	Waste Management Inc.	2,144,284	326,893	56.5
	CDM-1I	Monitor Well	CDM Smith	2,145,286	327,545	60
	CDM-2I	Monitor Well	CDM Smith	2,146,769	327,485	57
	CDM-3I	Monitor Well	CDM Smith	2,149,373	327,590	59
	CDM-5I	Monitor Well	CDM Smith	2,144,765	324,816	60
	CDM-6I	Monitor Well	CDM Smith	2,145,674	324,817	66
	CDM-7I	Monitor Well	CDM Smith	2,147,747	324,800	65
	CDM-8I	Monitor Well	CDM Smith	2,149,208	325,028	60
	CDM-102I	Piezometer	CDM Smith	2,148,383	327,888	50
	CDM-104I	Piezometer	CDM Smith	2,147,140	328,519	40
	CDM-106I	Piezometer	CDM Smith	2,145,779	328,373	50
Deep Zone of Surficial Aquifer	B-17D	Monitor Well	Waste Management Inc.	2,144,295	325,899	124.8
	B-19D	Monitor Well	Waste Management Inc.	2,144,283	326,898	109.0
	CDM-1D	Monitor Well	CDM Smith	2,145,280	327,546	100
	CDM-2D	Monitor Well	CDM Smith	2,146,765	327,488	100
	CDM-5D	Monitor Well	CDM Smith	2,144,760	324,816	111
	CDM-6D	Monitor Well	CDM Smith	2,145,679	324,816	110

Notes:

[1] Florida State Plane Coordinate System East Zone (HARN 83)

For onsite surface water management, the proposed expansion plan includes a landfill perimeter ditch along the west, north, and east boundary of the expansion area. The ditch will collect surface water runoff from the expansion area and convey it to a stormwater management facility (pond) which will be located east of the expansion area. There will be two discharge locations along the eastern boundary of the pond, which discharges to offsite wetlands.

A total of five surface water monitoring locations are proposed in accordance with Section 62-701.510(4), FAC. The monitoring locations are shown on Figure 3. One upgradient sampling location (SW-1) will be established at the headwaters of the bypass ditch near the southwest corner of the expansion area to monitor the background surface water quality. Three sampling locations (SW-2, SW-3, and SW-4) will be located at the point of discharge of the bypass pond and stormwater management facility. One sampling location (SW-5) will be established east of the stormwater pond discharge locations to monitor downgradient of the expansion area near the eastern property boundary.

2.3 Water Quality Monitoring Parameters and Frequency

The water quality monitoring program includes three separate sampling and analysis procedures: (1) initial background water quality monitoring, (2) routine semi-annual water quality monitoring, and (3) evaluation water quality monitoring . A description of the required parameters for initial background monitoring and routine monitoring for groundwater and surface water is included in **Table 3**. Evaluation monitoring is only required if a parameters is detected at a concentration in exceedance of applicable standards (See Section 2.3.3)

All sampling and analysis activities will be performed in general accordance with FDEP Standard Operating Procedures (SOPs) effective December 3, 2008 as referenced in FDEP's Quality Assurance Rule (Chapter 62-160, FAC). Prior to sampling any monitor well, groundwater level measurements will be recorded.

Table 3. Water Quality Monitoring Requirements for Solid Waste Facilities

Type of Monitoring	List of Parameters	Table No.
Initial Background Monitoring		
Groundwater	Groundwater Indicator, 40 CFR Part 258 Appendix I, and 40 CFR Part 258 Appendix II	Tables 4, 6, and 7
Surface Water	Surface Water Indicator and 40 CFR Part 258 Appendix I	Tables 5 and 6
Routine Semi-Annul Monitoring		
Groundwater	Groundwater Indicator and 40 CFR Part 258 Appendix I	Tables 4 and 6
Surface Water	Surface Water Indicator and 40 CFR Part 258 Appendix I	Tables 5 and 6

2.3.1 Initial Background Water Quality Monitoring

Initial background water quality for the proposed landfill is required to be determined by analysis of at least one groundwater sample from each well installed, and one water sample from each surface water monitoring location. The analytical parameters required for initial background water quality are included in **Tables 4** through **7**.

For groundwater samples, initial background water quality parameters include:

- Groundwater monitoring parameters (Table 4);
- Parameters listed in 40 CFR Part 258 Appendix I (Table 6); and

- Parameters listed in 40 CFR Part 258 Appendix II (Table 7).

For surface water samples, initial background water quality parameters include:

- Surface water indicator parameters (Table 5); and
- Parameters listed in 40 CFR Part 258 Appendix I (Table 6).

Initial background water quality monitoring of the proposed expansion area was completed as part of the background hydrologic and water quality monitoring plan in accordance with hydrogeologic regulatory requirements for solid waste management facilities described in Sections 62-701.410 and 62-701.510, FAC.

A total of 22 recently-installed CDM Smith monitor wells and 7 surface water monitoring stations were sampled for water quality parameters in April 2011 and October 2011. A summary of the initial background water quality monitoring are included below and additional details are available in the Hydrogeologic Summary and Background Monitoring Report located in Appendix P.

In accordance with Section 62-701.510(5)(b)(1), FAC, the new groundwater and surface water monitoring systems described in Sections 2.1 and 2.2 will be sampled for initial background water quality requirements once they are installed. In accordance with Section 62-701.510(8)(a), FAC, a notification will be sent to FDEP at least 14 days prior to sampling.

Table 4. Groundwater Monitoring Parameter List[1]

Parameter[1]	Units	Maximum Contaminant Level[2]
Field Parameters		
Static Water Level in Wells Before Purging	ft btoc	-
Specific Conductivity	mS/cm	-
pH	SU	6.5-8.5
Dissolved Oxygen (DO)	mg/L	-
Turbidity	NTU	-
Temperature	^{0}C	-
Colors and Sheens	-	15
ORP	mVolts	-
Laboratory Parameters		
Total Ammonia Nitrogen	mg/L	-
Chloride	mg/L	250
Iron	mg/L	300
Mercury	mg/L	2.0
Nitrate	mg/L	10
Sodium	mg/L	160
Total Dissolved Solids (TDS)	mg/L	500
Parameters Listed in 40 CFR Part 258, Appendix I	-	See Table 6

Notes:

[1] Taken from Section 62-701.510(7)(a), FAC - August 2012

[2] According to Chapter 62-550, FAC-Drinking Water Standards, Monitoring and Reporting - October 2010

Groundwater

To establish background groundwater quality, groundwater samples were collected at all 22 recently CDM Smith monitor wells in April 2011 and October 2011 and analyzed for the groundwater monitoring parameters (Table 4) and parameters listed in 40 CFR Part 258 Appendix I (Table 6). Although the groundwater samples were not analyzed for the parameters listed in 40 CFR Part 258 Appendix II (Table 7), any monitor wells, which remain after construction of the expansion area will be sampled for those parameters.

The results of the groundwater quality analysis were compared with Florida Department of Environmental Protection (FDEP) Primary and Secondary Drinking Water Standards (Chapter 62-550, FAC) since groundwater in the surficial aquifer is classified as a potential potable water source of supply (Class G-II). In April 2011 and October 2011, iron was the only parameter found to be in exceedance of applicable drinking water standards at the site. Iron concentrations exceeding the Maximum Contaminant Level (MCL) of 300 µg/L were detected in all 22 monitor wells in April 2011 and in 21 of the monitor wells in October 2011.

Table 5. Surface Water Monitoring Parameter List[1]

Parameter[1]	Units	Maximum Contaminant Level[2]
Field Parameters		
Specific Conductivity	mS/cm	1,275
pH	SU	6.0-8.5
Dissolved Oxygen (DO)	mg/L	5.0
Turbidity	NTU	< 29 Above Background
Temperature	^{0}C	-
Colors and Sheens	-	-
ORP	mVolts	-
Laboratory Parameters		
Unionized Ammonia (NH_3) Nitrogen	mg/L	0.02
Total Hardness	mg/L $CaCO_3$	-
Biochemical Oxygen Demand (BOD_5)	mg/L	-
Copper	mg/L	calculated
Iron	mg/L	1
Mercury	mg/L	0.000012
Nitrate Nitrogen	mg/L	-
Zinc	mg/L	calculated
Total Dissolved Solids (TDS)	mg/L	-
Total Organic Carbon (TOC)	mg/L	-
Fecal Coliform	cfu/100 mL	200
Total Phosphorus	mg/L P	-
Chlorophyll-a	mg/m^3	-
Total Nitrogen	mg/L	-
Chemical Oxygen Demand (COD)	mg/L	-
Total Suspended Solids (TSS)	mg/L	-
Parameters Listed in 40 CFR Part 258, Appendix I	-	See Table 6

Notes:

[1] Taken from Section 62-701.510(8)(b), FAC - January 2010

[2] According to Chapter 62-302, FAC-Surface Water Quality Standards for Class III Surface Water Bodies - August 2010

Surface Water

To establish background surface water quality, surface water samples were collected in April 2011 and October 2011 and analyzed for the surface water monitoring parameters (Table 5) and parameters listed in 40 CFR Part 258 Appendix I (Table 6). In April 2011 and October 2011, surface water samples were collected at three staff gauge locations (SG-R-3 through SG-R-5), which were the only staff gauges with standing water.

The results of the surface water quality analyses were compared with FDEP Class III surface water quality standards (Chapter 62-302, FAC) since the surface waters at this site are classified as freshwater, which could be used for fish consumption, recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife.

In April 2011, the dissolved oxygen concentration at SG-R-5 (1.94 mg/L) was below the minimum 5.0 mg/L standard. At SG-R-3, fecal coliform was measured at 420 cfu/100 mL, which exceeded the MCL of 200 cfu/100 ML. Also, at SG-R-3, beryllium was detected at 0.158 mg/L, which exceeded of the MCL of 0.13 µg/L.

In October 2011, the pH at SG-R-5 was measured at 5.33 S.U., which is below the MCL range of 6.0-8.5 S.U. Dissolved oxygen concentrations at SG-R-4 and SG-R-5 resulted in 4.51 mg/L and 1.74 mg/L, respectively, which were below the minimum 5.0 mg/L standard. At SG-R-3, fecal coliform was measured at 430 cfu/100 mL, which exceeded the MCL of 200 cfu/100 ML). The concentration of zinc at SG-R-5 resulted in 128 µg/L, which exceeded the MCL (calculated at 1.08 µg/L). At SG-R-5, beryllium was detected at 0.257 µg/L, which is in exceedance of the MCL for this parameter (0.13 µg/L).

Table 6. Parameters listed in 40 CFR Part 258, Appendix I

Parameter	Units	Groundwater Guidance Concentration[1] (µg/L)	Surface Water Maximum Contaminant Level[3] (µg/L)
Inorganics			
Antimony	µg/L	6.0[2]	4,300
Arsenic	µg/L	10[2]	50
Barium	µg/L	2,000[2]	-
Beryllium	µg/L	4.0[2]	0.13
Cadmium	µg/L	5.0[2]	calculated
Chromium	µg/L	100[2]	calculated
Cobalt	µg/L	-	-
Copper	µg/L	1,000[2]	calculated
Lead	µg/L	15[2]	calculated
Nickel	µg/L	100[2]	calculated
Selenium	µg/L	50[2]	5.0
Silver	µg/L	100[2]	0.07
Thallium	µg/L	2.0[2]	6.3
Vanadium	µg/L	49	-
Zinc	µg/L	5,000[2]	calculated
Organics			
Acetone	µg/L	700	-
Acrylonitrile	µg/L	8.0	-
Benzene	µg/L	1.0[2]	71.28
Bromochloromethane	µg/L	-	-
Bromodichloromethane	µg/L	0.6	22.0
Bromomethane	µg/L	10	-
Bromoform	µg/L	4.0	360
Carbon disulfide	µg/L	700	-
Carbon tetrachloride	µg/L	3.0[2]	4.42
Chlorobenzene	µg/L	100	-
Chloroethane	µg/L	140	-
Chloroform	µg/L	6.0	470.8
Chloromethane	µg/L	2.7	470.8
Dibromochloromethane	µg/L	1.0	-
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	0.2	-
1,2-Dibromoethane	µg/L	0.02[2]	-
Dibromomethane	µg/L	0.2	-
1,2-Dichlorobenzene	µg/L	600	-
1,4-Dichlorobenzene	µg/L	75.0	-
trans-1,4-Dichloro-2-butene	µg/L	1,400	-
1,1-Dichloroethane	µg/L	700	-
1,2-Dichloroethane	µg/L	3.0[2]	-
1,1-Dichloroethene	µg/L	7.0[2]	3.2
cis-1,2-Dichloroethene	µg/L	70[2]	-
trans-1,2-Dichloroethene	µg/L	100[2]	-
1,2-Dichloropropane	µg/L	5.0[2]	-

Table 6. Parameters listed in 40 CFR Part 258, Appendix I (cont.)

Parameter	Units	Groundwater Guidance Concentration[1] (µg/L)	Surface Water Maximum Contaminant Level[3] (µg/L)
cis-1,3-Dichloropropene	µg/L	1.0	-
trans-1,3-Dichloropropene	µg/L	1.0	-
Ethylbenzene	µg/L	700[2]	-
Methyl butyl ketone (2-hexanone)	µg/L	-	-
Methylene chloride	µg/L	5.0[2]	1,580
Methyl ethyl ketone (2-butanone)	µg/L	4,200	-
Methyl iodide (iodomethane)	µg/L	-	-
4-Methyl-2-pentanone	µg/L	350	-
Styrene	µg/L	100[2]	-
1,1,1,2-Tetrachloroethane	µg/L	1.0	-
1,1,2,2-Tetrachloroethane	µg/L	0.2	10.8
Tetrachloroethene	µg/L	3.0[2]	8.85
Toluene	µg/L	1,000[2]	-
1,1,1-Trichloroethane	µg/L	200[2]	270
1,1,2-Trichloroethane	µg/L	5.0[2]	16
Trichloroethene	µg/L	3.0[2]	80.7
Trichlorofluoromethane	µg/L	2,100	-
1,2,3-Trichloropropane	µg/L	42	-
Vinyl acetate	µg/L	250	-
Vinyl chloride	µg/L	1.0[2]	-
Xylenes	µg/L	10,000[2]	-

Notes:

[1] According to the State of Florida Ground Water Guidance Concentrations (FDEP, June 1994)

[2] Maximum Contaminant Level according to Chapter 62-550, FAC-Drinking Water Standards, Monitoring and Reporting - October 2010

[3] According to Chapter 62-302, FAC-Surface Water Quality Standards for Class III Surface Water Bodies - August 2010

Table 7. Parameters listed in 40 CFR Part 258, Appendix II

Parameters	Units	Groundwater Guidance Concentration[1] (µg/L)	Surface Water Maximum Contaminant Level[3] (µg/L)
Acenaphthene	µg/L	20.0	2.7
Acenaphthylene	µg/L	10.0	see note 4
Acetone	µg/L	700	-
Acetonitrile	µg/L	500	-
Acetophenone	µg/L	700	-
2-Acetylaminofluorene	µg/L	-	-
Acrolein	µg/L	110	-
Acrylonitrile	µg/L	8.0	-
Aldrin	µg/L	0.05	0.00014
Allyl chloride	µg/L	-	-
4-Aminobiphenyl	µg/L	-	-
Anthracene	µg/L	2,100	110
Antimony	µg/L	6.0[2]	4,300
Arsenic	µg/L	10[2]	50
Barium	µg/L	2,000[2]	-
Benzene	µg/L	1.0[2]	71.28
Benzo(a)anthracene	µg/L	4.0	see note 4
Benzo(b)fluoranthene	µg/L	4.0	see note 4
Benzo(k)fluoranthene	µg/L	4.0	see note 4
Benzo(ghi)perylene	µg/L	10.0	see note 4
Benzo(a)pyrene	µg/L	0.2	see note 4
Benzyl alcohol	µg/L	2,100	-
Beryllium	µg/L	4.0[2]	0.13
alpha BHC	µg/L	0.05	-
beta-BHC	µg/L	0.1	0.046
delta-BHC	µg/L	0.05	-
gamma-BHC	µg/L	-	-
Bis(2-chloroethoxy) methane	µg/L	10.0	-
Bis(2-chloroethyl) ether	µg/L	1.5	-
Bis(2-chloro-1-methylethyl) ether	µg/L	-	-
Bis(2-ethylhexyl) phthalate	µg/L	6.0	-
Bromochloromethane	µg/L	-	-
Bromodichloromethane	µg/L	0.6	22
Bromoform	µg/L	4.0	360
4-Bromophenyl phenyl ether	µg/L	10.0	-
Butyl benzyl phthalate	µg/L	1,400	-
Cadmium	µg/L	5.0[2]	calculated
Carbon disulfide	µg/L	700	-
Carbon tetrachloride	µg/L	3.0[2]	4.42
Chlordane	µg/L	2.0	0.00059
p-Chloroaniline	µg/L	28.0	-
Chlorobenzene	µg/L	100	-
Chlorobenzilate	µg/L	0.13	-
p-Chloro-m-cresol	µg/L	3,000	-

Table 7. Parameters listed in 40 CFR Part 258, Appendix II (cont.)

Parameters	Units	Groundwater Guidance Concentration[1] (µg/L)	Surface Water Maximum Contaminant Level[3] (µg/L)
Chloroethane	µg/L	140	-
Chloroform	µg/L	6.0	470.8
2-Chloronaphthalene	µg/L	560	-
2-Chlorophenol	µg/L	35.0	400
4-Chlorophenyl phenyl ether	µg/L	10.0	-
Chloroprene	µg/L	-	-
Chromium	µg/L	100[2]	calculated
Chrysene	µg/L	5.0	see note 4
Cobalt	µg/L	-	-
Copper	µg/L	1,000[2]	calculated
m-Cresol	µg/L	350	-
o-Cresol	µg/L	350	-
p-Cresol	µg/L	35.0	-
Cyanide	µg/L	200	5.2
2,4-D	µg/L	70.0	-
4,4-DDD	µg/L	0.1	-
4,4-DDE	µg/L	0.1	-
4,4-DDT	µg/L	0.1	0.00059
Diallate	µg/L	0.57	-
Dibenz(a,h)anthracene	µg/L	7.5	see note 4
Dibenzofuran	µg/L	-	-
Dibromochloromethane	µg/L	1.0	-
1,2-Dibromo-3-chloropropane	µg/L	0.2	-
1,2-Dibromoethane	µg/L	0.02[2]	-
Di-n-butyl phthalate	µg/L	700	-
1,2-Dichlorobenzene	µg/L	600	-
1,3-Dichlorobenzene	µg/L	10.0	-
1,4-dichlorobenzene	µg/L	75.0	-
3,3-Dichlorobenzidine	µg/L	7.5	-
trans-1,4-Dichloro-2-butene	µg/L	-	-
Dichlorodifluoromethane	µg/L	1,400	-
1,1-Dichloroethane	µg/L	700	-
1,2-Dichloroethane	µg/L	3.0[2]	-
1,1-Dichloroethene	µg/L	7.0[2]	3.2
cis-1,2-Dichloroethene	µg/L	70[2]	-
trans-1,2-Dichloroethene	µg/L	100[2]	-
2,4-Dichlorophenol	µg/L	4.0	790
2,6-Dichlorophenol	µg/L	4.0	-
1,2-Dichloropropane	µg/L	5.0[2]	-
1,3-Dichloropropane	µg/L	-	-
2,2-Dichloropropane	µg/L	1.0	-
1,1-Dichloropropene	µg/L	-	-
cis-1,3-Dichloropropene	µg/L	1.0	-
trans-1,3-Dichloropropane	µg/L	1.0	-

Table 7. Parameters listed in 40 CFR Part 258, Appendix II (cont.)

Parameters	Units	Groundwater Guidance Concentration[1] (µg/L)	Surface Water Maximum Contaminant Level[3] (µg/L)
Dieldrin	µg/L	0.1	0.00014
Diethyl phthalate	µg/L	5,600	-
0,0-Diethyl 0-2-pyrazinyl phosphorthioate (Thionazin)	µg/L	-	-
Dimethoate	µg/L	5.0	-
p-(Dimethylamino)azobenzene	µg/L	4.0	-
7,12-Dimethylbenz(a)anthracene	µg/L	-	-
3,3-Dimethylbenzidine	µg/L	250	-
2,4-Dimethylphenol	µg/L	400	-
Dimethyl phthalate	µg/L	70,000	-
m-Dinitrobenzene	µg/L	50.0	-
4,6-Dinitro-2-methylphenol	µg/L	-	-
2,4-Dinitrophenol	µg/L	30.0	14.26
2,4-Dinitrotoluene	µg/L	0.2	9.1
2,6-Dinitrotoluene	µg/L	0.2	-
Dinoseb	µg/L	7.0[2]	-
Di-n-octyl phthalate	µg/L	140	-
Diphenylamine	µg/L	175	-
Disulfoton	µg/L	0.5	-
Endosulfan I	µg/L	0.35	0.056
Endosulfan II	µg/L	-	0.056
Endosulfan sulfate	µg/L	0.3	-
Endrin	µg/L	2.0[2]	0.0023
Endrin aldehyde	µg/L	0.1	-
Ethylbenzene	µg/L	700[2]	-
Ethyl methacrylate	µg/L	630	-
Ethyl methanesulfonate	µg/L	-	-
Famphur	µg/L	-	-
Fluoranthene	µg/L	280	0.370
Fluorene	µg/L	280	14
Heptachlor	µg/L	0.4[2]	0.00021
Heptachlor epoxide	µg/L	0.2[2]	-
Hexachlorobenzene	µg/L	1.0[2]	-
Hexachlorobutadiene	µg/L	15.0	49.7
Hexachlorocyclopentadiene	µg/L	50.0[2]	-
Hexachloroethane	µg/L	10.0	-
Hexachloropropene	µg/L	6.0	-
2-Hexanone	µg/L	-	-
Indeno (1,2,3-cd) pyrene	µg/L	7.5	see note 4
Isobutyl alcohol	µg/L	2,100	-
Isodrin	µg/L	-	-
Isophorone	µg/L	40.0	-
Isosafrole	µg/L	-	-
Kepone	µg/L	-	-

Table 7. Parameters listed in 40 CFR Part 258, Appendix II (cont.)

Parameters	Units	Groundwater Guidance Concentration[1] (µg/L)	Surface Water Maximum Contaminant Level[3] (µg/L)
Lead	µg/L	15[2]	calculated
Mercury	µg/L	2.0[2]	0.012
Methacrylonitrile	µg/L	50.0	-
Methapyrilene	µg/L	-	-
Methoxychlor	µg/L	40.0[2]	0.03
Methyl bromide	µg/L	10.0	-
Methyl chloride	µg/L	2.7	470.8
3-Methylcholanthrene	µg/L	-	-
Methyl ethyl ketone	µg/L	4,200	-
Methyl iodide	µg/L	-	-
Methyl methacrylate	µg/L	25.0	-
Methyl methanesulfonate	µg/L	-	-
2-Methylnaphthalene	µg/L	-	-
Methyl parathion	µg/L	10.0	-
4-Methyl-2-pentanone	µg/L	350	-
Methylene bromide	µg/L	-	-
Methylene chloride	µg/L	5.0[2]	1,580
Naphthalene	µg/L	6.8	-
1,4-Naphthoquinone	µg/L	-	-
1-Naphthylamine	µg/L	-	-
2-Naphthylamine	µg/L	-	-
Nickel	µg/L	100[2]	calculated
o-Nitroaniline	µg/L	7.5	-
m-Nitroaniline	µg/L	-	-
p-Nitroaniline	µg/L	-	-
Nitrobenzene	µg/L	9.5	-
o-Nitrophenol	µg/L	20.0	-
p-Nitrophenol	µg/L	15.0	-
N-Nitrosodi-n-butylamine	µg/L	4.0	-
N-Nitrosodiethylamine	µg/L	4.0	-
N-Nitrosodimethylamine	µg/L	7.5	-
N-Nitrosodiphenylamine	µg/L	7.0	-
N-Nitrosodipropylamine	µg/L	4.0	-
N-Nitrosomethylethylamine	µg/L	7.5	-
N-Nitrosopiperidine	µg/L	-	-
N-Nitrosopyrrolidine	µg/L	4.0	-
5-Nitro-O-toluidine	µg/L	-	-
Parathion	µg/L	42.0	-
Pentachlorobenzene	µg/L	5.6	-
Pentachloronitrobenzene	µg/L	15.0	-
Pentachlorophenol	µg/L	1.0[2]	8.2
Phenacetin	µg/L	-	-
Phenanthrene	µg/L	10.0	see note 4
Phenol	µg/L	10.0	0.3

Table 7. Parameters listed in 40 CFR Part 258, Appendix II (cont.)

Parameters	Units	Groundwater Guidance Concentration[1] (µg/L)	Surface Water Maximum Contaminant Level[3] (µg/L)
p-Phenylenediamine	µg/L	1,330	-
Phorate	µg/L	1.4	-
Polychlorinated biphenyls	µg/L	0.5[2]	0.000045
Pronamide	µg/L	525	-
Propionitrile	µg/L	-	-
Pyrene	µg/L	210	11
Safrole	µg/L	-	-
Selenium	µg/L	50[2]	5.0
Silver	µg/L	100[2]	0.07
2,4,5-TP	µg/L	50.0[2]	-
Styrene	µg/L	100[2]	-
Sulfide	µg/L	-	-
2,4,5-T	µg/L	70.0	-
1,2,4,5-Tetrachlorobenzene	µg/L	4.0	-
1,1,1,2-Tetrachloroethane	µg/L	1.0	-
1,1,2,2,-Tetrachloroethane	µg/L	0.2	10.8
Tetrachloroethylene	µg/L	3.0[2]	8.85
2,3,4,6-Tetrachlorophenol	µg/L	210	-
Thallium	µg/L	2.0[2]	6.3
Tin	µg/L	4,200	-
Toluene	µg/L	1,000[2]	-
o-Toluidine	µg/L	50.0	-
Toxaphene	µg/L	3.0[2]	0.0002
1,2,4-Trichlorobenzene	µg/L	70[2]	-
1,1,1-Trichloroethane	µg/L	200[2]	-
1,1,2-Trichloroethane	µg/L	5.0[2]	-
Trichloroethylene	µg/L	3.0[2]	80.7
Trichlorofluoromethane	µg/L	2,100	-
2,4,5-Trichlorophenol	µg/L	4.0	-
2,4,6-Trichlorophenol	µg/L	10.0	6.5
1,2,3-Trichloropropane	µg/L	42.0	-
0,0,0,-Triethyl phosphorothioate	µg/L	-	-
sym-Trinitrobenzene	µg/L	60.0	-
Vanadium	µg/L	49	-
Vinyl acetate	µg/L	250	-
Vinyl chloride	µg/L	1.0[2]	-
Xylene (total)	µg/L	10,000[2]	-
Zinc	µg/L	5,000[2]	calculated

Notes:

[1] According to the State of Florida Ground Water Guidance Concentrations (FDEP, June 1994)

[2] Maximum Contaminant Level according to Chapter 62-550, FAC-Drinking Water Standards, Monitoring and Reporting - October 2010

[3] According to Chapter 62-302, FAC-Surface Water Quality Standards for Class III Surface Water Bodies - August 2010

[4] The total concentration of these compounds cannot exceed a concentration 0.031 ug/l on an annual average basis

2.3.2 Routine Water Quality Monitoring

Routine water quality monitoring will occur on a semi-annual basis for the proposed expansion area. The semi-annual monitoring events will occur in April and October of each year, corresponding to the end of the dry season and end of the wet season, respectively, in northeast Florida. In accordance with Section 62-701.510(8)(a), FAC, a notification will be sent to FDEP at least 14 days prior to sampling.

In accordance with Section 62-701.510(5)(c), FAC, routine groundwater monitoring will include semi-annual sampling of all detection monitor wells, and a representative sample of background wells. The samples collected from shallow zone background and detection monitor wells will be analyzed for the groundwater monitoring parameters (Table 4) and the parameters listed in 40 CFR Part 258 Appendix I (Table 6). The samples collected from deep zone background and detection monitor wells will be analyzed for field parameters and the following leachate indicator parameters: total ammonia nitrogen, chloride, nitrate, sodium, iron, and total dissolved solids (TDS). If the results of analysis indicate that leachate is impacting groundwater (elevated concentrations of the sampled constituents) in samples from the deep zone monitor well, the monitor well will be resampled and the sample will be analyzed for the groundwater monitoring parameters (Table 4) and the parameters listed in 40 CFR Part 258 Appendix I (Table 6).

In accordance with Section 62-701.510(5)(d), FAC, routine surface water monitoring will include semi-annual sampling of all surface water monitoring locations. The samples will be analyzed for the surface water monitoring parameters (Table 5) and the parameters listed in 40 CFR Part 258 Appendix I (Table 6).

2.3.3 Evaluation Monitoring

If monitoring parameters are detected in detection monitor wells at concentrations that are significantly above background concentrations or at concentrations that exceed the groundwater guidance concentrations or MCLs specified in Tables 4 and 6, the detection monitor well(s) will be resampled within 30 days of receipt of sampling data to confirm the result. If the data is confirmed, a notification will be sent to FDEP within 14 days.

In the event that a confirmed exceedance of applicable standards occurs at a detection well, the City will implement evaluation monitoring procedures defined in Section 62-701.510(6), FAC. This will include the installation and sampling of necessary downgradient compliance well(s) described in Section 2.1.3 and the completion of a contamination evaluation plan described in Section 62-701.510(6)(a)(4), FAC.

3.0 Water Quality Monitoring Reporting

The water quality reporting procedures for the Trail Ridge Landfill proposed expansion area were developed in accordance with water quality monitoring requirements for solid waste management specified in Section 62-701.510(8), FAC. Semi-annual monitoring reports will be prepared based on the results of routine semi-annual water quality monitoring activities and submitted to FDEP within 60 days of receipt of the laboratory analytical results. The reports will include:

- Background and introductory information for the proposed landfill expansion area;
- The water quality sample collection dates and analysis dates;
- Groundwater and surface water monitoring system information;
- Analytical results of the monitoring event and comparison of results to applicable standards;
- Laboratory analytical reports including quality assurance and quality control notations and method detection limits;
- Groundwater level information for each monitor well in the system;
- Water level information for each surface water monitoring location;
- An updated groundwater level contour map;
- A summary of any water quality standard or criteria that are exceeded;
- A completed Water Quality Monitoring Certification Form, Section 62-701.900(31), FAC; and
- Field sampling data and laboratory water quality data in electronic format in accordance with Subsections 62-160.240(3) and 62-160.340(4), FAC.

During the active life of the facility, a technical report will be prepared every two and half years which summarizes and interprets water quality and water level information collected during the past two and half years. In accordance with Section 62-701.510(8)(b), the technical report will be prepared, signed, and sealed by a professional geologist or engineer with experience in hydrogeologic investigations and will include:

- Tabular displays of any detected monitoring parameter
- Graphical displays of any key leachate indicator parameters detected such as pH, specific conductance, TDS, TOC, sulfate, chloride, sodium,a nd iron;
- Hydrographs of all monitor wells;
- Trend analysis of any monitoring parameter consistently detected;
- Comparisons among shallow and deep zone monitor wells;
- Comparisons between upgradient background water quality and downgradient water quality in detection and compliance monitor wells and surface water monitoring locations;
- Correlatations between related parameters such as TDS and specific conductance;

- Discussion of erratic and/or poorly coorrelated data;
- Interpretation of the groundwater contour maps and evaluation of groundwater flow rates; and
- An evaluation of the adequeacy of the water quality monitoring frequency and sampling locations based upon site conditions.

4.0 Summary, Conclusions and Recommendations

4.1 Summary and Conclusions

A water quality monitoring program was developed for the Trail Ridge Landfill expansion area using site hydrogeologic data including the direction of groundwater flow and surface water flow patterns described in the Hydrogeologic Summary and Background Monitoring Report (Appendix P of the Solid Waste Landfill Permit Application), the monitoring program for the existing landfill, the landfill expansion design and the minimum requirements contained in Section 62-701.510, FAC.

As described in the Hydrogeologic Summary and Background Monitoring Report, the horizontal groundwater flow direction in both surficial aquifer units (water table unit and limestone unit) at the landfill expansion area was toward the northeast, from a groundwater high located at the southwest corner of the proposed expansion area. This groundwater flow pattern defines the background upgradient (background) and downgradient (detection) directions for siting of monitor wells.

The groundwater quality monitoring program will consist of installing background and detection monitor wells that will be sampled semiannually for the parameters listed in Section 62-701.510, FAC. Eight background wells, two existing wells (CDM-7S and CDM-7D) and six new wells installed in three clusters of shallow and deep wells will monitor groundwater along the western boundary of the site. Nineteen new detection monitor wells will be installed along eastern and northern side of the landfill expansion area. Shallow detection monitor wells will be installed at 13 locations. Deep detection monitor wells will be installed at 6 of the shallow well locations.

Stormwater runoff and surface waters flow off of Trail Ridge towards Deep Creek from west to east. The surface water quality monitoring program will consist of installing upgradient (background), point of discharge and downgradient surface water monitoring stations that will be sampled semiannually for the parameters listed in Section 62-701.510, FAC. A total of five surface water monitoring locations were established in accordance with Section 62-701.510(4), FAC. One upgradient sampling location (SW-1) will be established at the headwaters of the bypass ditch near the southwest corner of the expansion area to monitor the background surface water quality. Three sampling locations (SW-2, SW-3, and SW-4) will be located at the point of discharge of the bypass pond and stormwater management facility. One sampling location (SW-5) will be established east of the stormwater pond discharge locations to monitor downgradient of the expansion area near the eastern property boundary.

Semi-annual monitoring reports will be prepared in accordance with Section 62-701.510(8), based on the results of routine semi-annual water quality monitoring activities and submitted to FDEP. During the active life of the facility, a technical report will be prepared every two and half years which summarizes and interprets water quality and water level information collected during the past two and half years.

4.2 Recommendations

Once implemented, the water quality analyses performed in accordance with this water quality monitoring plan can be used to identify the typical background and downgradient water quality expected for the facility. The following are recommendations for the water quality monitoring program:

- It is recommended that deep monitor wells be installed at every other background and detection well cluster.
- The shallow monitor wells will be sampled semiannually for the field and groundwater indicator parameters including the, as defined by rule.
- The deep monitor wells will be sampled semiannually for the field and groundwater indicator parameters excluding mercury and the Part 258, Appendix I parameters. If the results of analysis indicate that leachate is impacting groundwater (elevated concentrations of the sampled constituents) in samples from the deep zone monitor well, the monitor well will be resampled and the sample will be analyzed for the groundwater monitoring parameters and the parameters listed in 40 CFR Part 258 Appendix I
- If there is no evidence of leachate impacting groundwater in the deep zone detection wells after a cell has been operational and sampled after 5 to 10 years, it is recommended that the requirement for sampling and analysis of the deep zone wells be reevaluated.