

Prepared for:



JEA

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INDUSTRIAL WASTEWATER AND SOLID WASTE GROUNDWATER MONITORING PLANS

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**Industrial Wastewater and Solid Waste
Groundwater Monitoring Plans**

**St. Johns River Power Park
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1. INTRODUCTION

1.1 Terms of Reference

These Industrial Wastewater and Solid Waste Groundwater Monitoring Plans (GMPs) were prepared by CDM Smith (CDM) and CDM's contractor, Geosyntec Consultants (CDM Team) on behalf of JEA for the St. Johns River Power Park (SJRPP), located at 11201 New Berlin Road in Jacksonville, Duval County, Florida in Section 12, Township 1 South, and Range 27 East, as illustrated in **Figure 1**.

1.2 Background

Since prior to SJRPP operation, JEA has been monitoring groundwater quality in accordance with SJRPP's Conditions of Certification which provided details for groundwater monitoring up-gradient and down-gradient from each solid waste disposal area, each liquid waste pond and each coal pile storage area.

GMPs have been also prepared for the Area II and Area B Landfills to supplement the SJRPP's Conditions of Certification. The CDM Team prepared a GMP as Appendix F of the document entitled "JEA St Johns River Power Park, Closure Design Plan Area II Landfill Revision 2" prepared by the CDM Team and dated July 2010. Golder Associates prepared a GMP for the Area B Landfill, dated April 2007, which was associated with the hydrogeological and geotechnical site evaluation for the Area B Landfill.

1.3 Objectives

In accordance with Section B, I.B.2, and I.G.2 of the Conditions of Certification (COC) for the JEA SJRPP – Units 1 and 2 dated 30 May 2012, this GMP has been updated to present the methodologies necessary to monitor and evaluate groundwater quality at the SJRPP up-gradient and down-gradient of the solid waste landfill and industrial sites.

1.4 Zone of Discharge

In Section B, O., of the COC, the Zone of Discharge (ZOD) for the solid waste landfills, sludge disposal test cells, coal, storage piles, wastewater treatment pond, and sedimentation ponds is defined as extending to a depth of 90 feet below the landfill cell or pond at a horizontal distance of 200 feet from the edge of the landfill cell or pond(s).

1.5 **Report Organization**

The remainder of this GMP is organized as follows:

- Section 2 – *Site Summary* – provides a site summary, including site description and setting, property use/ownership, site topography, site geology and hydrogeology, and surface water and drainage;
- Section 3 – *Industrial Groundwater Monitoring Plan* – presents details of the GMP including monitoring well locations, monitoring well construction details, water sample collection frequency, and water quality parameters for the industrial wastewater areas;
- Section 4 – *Solid Waste Groundwater Monitoring Plan* – presents details of the GMP including monitoring well locations, monitoring well construction details, water sample collection frequency, and water quality parameters for the solid waste locations;
- Section 5 – *References* – provides references that were utilized in the preparation of this GMP.

2. SJRPP SUMMARY

2.1 Ownership/Property Use

The SJRPP is authorized to utilize coal and petroleum coke in two large steam units to produce electricity for JEA and Florida Power & Light. JEA is the property owner by deed; however, the ownership interest is modified by a Joint Operating Agreement which currently allocates 80% interest to JEA and 20% interest to Florida Power & Light.

2.2 SJRPP Description and Setting

The SJRPP consists of a plant rail loop which encompasses the electric power generating mechanics, an area to store coal (Coal Storage Area), and basins to collect wastewater (Wastewater Basins). A perimeter ditch located on the exterior of the plant rail loop collects and conveys stormwater runoff to a retention pond prior to discharge off-site. Consistent with historical groundwater monitoring, two industrial groundwater monitoring and three landfill monitoring areas have been identified where groundwater monitoring will be conducted as part of the GMPs. Each area is detailed below and shown on **Figure 2**.

2.2.1 Industrial Waste Water Monitoring Areas

2.2.1.1 Coal and Limestone Storage Area

The Coal Storage Area is located within the plant rail loop and encompasses the southern portion of the plant rail loop, as illustrated on **Figure 2**. The Coal and Limestone Storage Area includes (i) the Coal Storage Area; (ii) two lined surface water sedimentation basins used to retain surface water from the Coal and Limestone Storage Area; and (iii) two lined surface water sedimentation basins for metal cleaning operations. Monitoring wells associated with Coal Storage Monitoring Area are designated with a “C” (i.e. C-1 through C-7).

2.2.1.2 Wastewater Basin Area

The Wastewater Basin Area is located within the plant rail loop north of the Coal Storage Area, as illustrated on **Figure 2**. The Wastewater Basin Area includes (i) two lined wastewater flow equalization basins; and (ii) two lined oily wastewater collection basins. Monitoring wells associated with Wastewater Basin Area are designated with a “B” (i.e. B-1 through B-4).

2.2.2 Landfill Areas

2.2.2.1 Area I Landfill

The Area I Landfill is located east of the two cooling towers and encompasses the Area I Landfill and Pond 1, as illustrated in **Figure 2**. The major solid waste components in the Area I Landfill include coal combustion products (CCPs), such as gypsum (flue gas desulfurization (FGD) byproduct) and coal combustion ash in the form of fly ash and bottom ash. Other small quantities of solid waste associated with electric power generation activities including pyrites, settled solids from the sedimentation basin/ponds and cooling towers, and dewatered solids from SJRPP's Wastewater Treatment Facility have been disposed in the Area I Landfill.

The Area I Landfill was formerly closed and a final Closure Certification Report was submitted to FDEP in April 2008 (Golder 2008). The Area I Landfill is approximately 57 acres, 95-ft in height, and has an average 3 horizontal to 1 vertical (3H:1V) side slopes. The top deck cover system consists of the following from top to bottom: (i) 2-ft thick cap protective soil layer; (ii) 40-mil thick smooth linear low density polyethylene (LLDPE) geomembrane; and (iii) graded subgrade layer consisting of CCPs. The 3H:1V side slopes consist of a 2-ft thick cap protective soil layer and a graded subgrade layer consisting of CCPs (Golder 2008).

Pond 1 is an un-lined industrial wastewater pond that receives water from the ash handling area and from Area B Byproduct Storage Area (BSA) active area. Water from Pond 1 is transferred to SJRPP's Wastewater Treatment Facility.

2.2.2.2 Area II Landfill

The Area II Landfill is located north of the two cooling towers and encompasses the Area II Landfill, as illustrated in **Figure 2**. The major solid waste components in the Area II Landfill include CCPs and other small quantities of solid waste associated with electric power generation activities including pyrites, settled solids from the sedimentation basin/ponds and cooling towers, and dewatered solids from SJRPP's Wastewater Treatment Facility.

The Area II Landfill was formerly closed in August 2011 and a final Closure Certification Report was submitted to the FDEP on 6 December 2011. FDEP approved the closure of the Area II Landfill in a letter dated 1 May 2012. The Area II Landfill is approximately 32 acres in size and has an average 3H:1V side slope. The approximate elevation of the Area II Landfill is approximately 94-ft NGVD29 at the crown of the top deck. Like the Area I Landfill, the top deck cover system consists of the following

from top to bottom: (i) 2-ft thick cap protective soil layer; (ii) 40-mil thick smooth LLDPE geomembrane; and (iii) graded subgrade layer consisting of CCPs. The 3H:1V side slopes consist of a 2-ft thick cap protective soil layer and a graded subgrade layer consisting of CCPs.

2.2.2.3 Area B Landfill

The Area B Landfill is located northeast of the Area I Landfill on the north side of Island Drive, as illustrated in **Figure 2**. Currently, the Area B Landfill receives CCPs and other small quantities of solid waste associated with electric power generation activities including pyrites, settled solids from the sedimentation basin/ponds and cooling towers, and dewatered solids from SJRPP's Wastewater Treatment Facility. The Area B Landfill is currently the only active solid waste unit in the SJRPP. The Area B Landfill is being developed in a northward direction until capacity is reached.

2.3 SJRPP Topography/Drainage

In general, the topography of the SJRPP slopes gently to the east southeast towards the St. Johns River, located 1 mile to south of the SJRPP. According to the United States Geologic Survey (USGS) Quadrangle topographic maps, the approximate land surface elevation at the SJRPP is approximately 20-ft National Geodetic Vertical Datum of 1929 (NGVD29).

2.4 Regional and SJRPP Hydrogeology

The hydrogeology of Duval County, including the SJRPP, has been documented in many publications (Leve, 1966; Fairchild, 1972; Phelps, 1993 and others). As documented in Florida Geological Survey Report of Investigations No. 59, *The Shallow-Aquifer System in Duval County, Florida* (Fairchild, 1972), the stratigraphic series, in descending order, that comprise the surficial aquifer system in Duval County (including the SJRPP site) are the Pleistocene and Holocene deposits and the upper Miocene or Pliocene deposits. The Pleistocene and Holocene deposits comprise the water table unit and the upper Miocene or Pliocene deposits comprise the limestone unit (Phelps, 1993). The surficial aquifer is approximately 30 to 90 feet thick at the site. Within Duval County, the Pleistocene and Holocene deposits consist of sand, tan to yellow, loose, medium to fine quartz, sometimes with shells and/or minor clay content. The upper Miocene or Pliocene deposits consist of two parts; the upper and lower. The upper part consists of tan to buff, fine to coarse sand and gray to light gray sandy clay, clayey sand, and shell beds. The lower part consists of tan to yellow, often highly sandy, porous, and cavernous with a few sections of dolomitic limestone. The thickness of the upper Miocene or Pliocene deposits ranges from 10 to 100-ft.

Underlying the surficial aquifer system deposits are the Miocene deposits comprising the Hawthorn Group, also referred to as the Intermediate Confining Unit. The Hawthorn Group consists of gray to blue-green and olive-green clay, sandy clay, and sandy limestone, well-rounded, polished, granules and pebbles of phosphate with a thickness ranging from 250 to 500-ft in Duval County. At the site, the Hawthorn Group Formation is over 500 feet thick (Phelps, 1993). Throughout most of northeast Florida, the Hawthorn Group serves as a confining layer that minimizes movement of water between the surficial aquifer system and the underlying artesian Floridian Aquifer.

The surficial aquifer system at the site is approximately 90-ft thick. For the purposes of the groundwater monitoring programs, the surficial aquifer has been divided into three separate zones: the shallow, intermediate, and deep. The shallow aquifer zone extends from the top of the water table (10 to 12 ft below land surface [bls]) to approximately 25 ft bls. The intermediate aquifer zone extends from approximately 25 ft bls to approximately 45 ft bls. The deep aquifer extends from approximately 50 to 90-ft bls. **Table 1** summarizes the construction data and aquifer zone for each monitoring well.

2.5 SJRPP Groundwater Flow Direction and Gradient

Spring (April 2010) and fall (October 2010) groundwater elevations collected at the SJRPP were used to evaluate potential seasonal changes in groundwater flow direction due to variations in groundwater elevations. Based on 2010 spring (April 2010) groundwater elevation data, groundwater flow in the intermediate aquifer zone is from generally northwest to southeast towards the St. Johns River, as illustrated in **Figure 3**. The average groundwater flow gradient in the intermediate aquifer zone is approximately 0.002 ft/ft.

Based on 2010 fall (October 2010) groundwater elevation data, groundwater flow in the intermediate aquifer zone is from generally northwest to southeast towards the St. Johns River, as illustrated in **Figure 4**. The average groundwater flow gradient in the intermediate aquifer zone is approximately 0.002 ft/ft.

This data suggests that there is little to no significant seasonal variation in the direction of groundwater flow or the gradient at the SJRPP.

3. INDUSTRIAL WASTEWATER GROUNDWATER MONITORING PLAN

3.1 Introduction

This section presents the Industrial Wastewater GMP for the SJRPP and encompasses the Coal and Limestone Storage Area and Wastewater Basin Areas (**Figure 2**). This section summarizes the site-specific geology and hydrogeology, water quality, monitoring well network, parameters, and sampling frequency for each monitoring area.

3.2 Monitoring Area Geology

Based on a lithologic log from monitoring well C-4 (located along the southern plant rail loop), as documented in JEA's *Groundwater Monitoring Well Program, Design and Location Information Report*, the following stratigraphy is representative of conditions in the southern portion of the SJRPP near the Coal Storage Area and the Wastewater Basins:

- dense light bluish grey sand with clayey sand was documented from approximately 7 to 22-ft below land surface (bls);
- dense tan to orange fine to medium sand was documented from approximately 22 to 32-ft bls;
- dense light tan medium to fine sand with fragments of well cemented brown silt was documented from 32 to 42-ft bls;
- very dense dark grey slightly silty or clayey sand was documented from 42 to 52-ft bls;
- very dense green to dark blue-green clay was documented from 52 to 67- ft bls;
- very dense light grey brown slightly clayey fine sand was documented from 67 to 76-ft bls; and
- very dense buff to tan shell fragments and trace fine sand was documented from 76 to 85.5-ft bls.

3.3 Hydrogeology

3.3.1 Coal and Limestone Storage Area

Groundwater elevations in the intermediate (approximately 33 to 43-ft bls) and deep (approximately 72 to 82-ft bls) zones of the surficial aquifer have been recorded quarterly since October 2008 in monitoring wells (C-1 through C-7) located on the perimeter of the Coal Storage Monitoring Area. Based on 2010 groundwater elevation data, groundwater flow in the intermediate zone of the surficial aquifer is generally from northwest to east, as illustrated in **Figure 5** and **Figure 6**. The groundwater flow direction is generally consistent during the spring (April 2010) and fall (October 2010). Groundwater flow in the deep zone of the surficial aquifer is generally from northwest to east with a slight southeastern component, as illustrated in **Figure 5** and **Figure 6**. During the spring (April 2010), the southeastern component in the deep surficial aquifer appears to be more significant.

Based on the April and October 2010 groundwater elevation data, the average horizontal gradient in the intermediate surficial aquifer was 0.0019 ft/ft and the average horizontal gradient in the deep surficial aquifer was 0.0012 ft/ft. The average vertical gradient between the intermediate and deep zones of the surficial aquifer is 0.01 ft/ft upwards from the deep to the intermediate zones of the surficial aquifer.

3.3.2 Wastewater Basins Area

Groundwater elevations in the intermediate aquifer have been recorded quarterly since 1995 in monitoring wells B-1 through B-4 located in the Wastewater Basins Monitoring Area. Based on 2010 groundwater elevation data, groundwater flow in the intermediate zone of the surficial aquifer is generally west to east with a southeastern component, as illustrated in **Figure 7** and **Figure 8**. The groundwater flow direction is consistent during the spring (April 2010) and fall (October 2010). The average horizontal gradient in the intermediate zone of the surficial aquifer was calculated from the April and October 2010 groundwater elevation data collected from monitoring wells B-1 through B-3. The average horizontal gradient in the intermediate zone of the surficial aquifer was calculated as 0.002 ft/ft.

3.4 Groundwater Monitoring Network

3.4.1 Coal and Limestone Storage Area

Seven monitoring wells (C-1 through C-7) comprise the groundwater monitoring network for the Coal and Limestone Storage Area. Two monitoring wells (C-1 and C-

2) are up-gradient of the Coal and Limestone Storage Area and five monitoring wells (C-3 through C-7) are down-gradient of the Coal and Limestone Storage Area. Intermediate surficial aquifer monitoring wells include C-1, C-3, C-5, and C-6 and deep surficial aquifer monitoring wells include C-2, C-4, and C-7. These monitoring wells will be utilized to monitor groundwater quality up and down-gradient of the Coal Storage Area.

The ZOD for the Coal and Limestone Storage Area is defined as extending to a depth of 90 feet below the Coal and Limestone Storage Area at a horizontal distance of 200 feet from the Coal and Limestone Storage Area. Therefore based on the ZOD definition and in accordance with Rule 62-520, C-1 and C-2 are designated Background Monitoring Wells because they are located up-gradient of the Coal and Limestone Storage Area; and C-3 through C-7 are designated Intermediate Monitoring Wells because they are located within the Coal and Limestone Storage Area ZOD.

Monitoring well construction details for the Coal and Limestone Storage Area monitoring wells are provided in **Table 1**. Geographical coordinates and designation types for monitoring wells associated with the Coal and Limestone Storage Area are provided in **Table 2**.

3.4.2 Wastewater Basin Area

Four monitoring wells (B-1 through B-4) comprise the groundwater monitoring network for the Wastewater Basin Area. One groundwater monitoring well (B-1) is up-gradient of the Wastewater Basin and down-gradient of the Sedimentation Basin and three monitoring wells (B-2 through B-4) are down-gradient of the Wastewater Flow Equalization Basins. Monitoring wells B-1 through B-4 are screened within the intermediate groundwater aquifer.

The ZOD for the Wastewater Basin Area is defined as extending to a depth of 90 feet below the Wastewater Basin Area at a horizontal distance of 200 feet from the Wastewater Basin Area. Therefore based on the ZOD definition and in accordance with Rule 62-520, B-1 through B-4 are designated Intermediate Monitoring Wells because they are located within the Wastewater Basin Area ZOD.

Well construction details for monitoring wells associated with the Wastewater Basin Area are provided in **Table 1**. Geographical coordinates and designations for monitoring wells associated with the Wastewater Basins are provided in **Table 2**.

3.4.3 Monitoring Well Installation and Replacement

If any monitoring well becomes damaged or inoperable, the SJRPP will notify the FDEP's Northeast District Office and a detailed written report will follow within seven working days. FDEP shall be notified at least 72 hours in advance prior to the installation of any groundwater monitoring well. All monitoring wells will be constructed in accordance with Chapter 62-520 and installed by a licensed water well contractor. A boring should be made for each monitoring well in order to properly determine the well depth.

Piezometers and monitoring wells not part this GMP will be plugged and abandoned in accordance with Rule 62-532.500(4), unless future use is intended.

3.5 Groundwater Sampling, Parameters, and Frequency

3.5.1 Groundwater Sampling

Groundwater samples will be collected from C-1 through C-7 and B-1 through B-4 in accordance with FDEP's Standard Operating Procedures Manual for Field Sampling, and shall conform to the applicable Quality Assurance/Quality Control requirements of Chapter 62-160, F.A.C. (SOPs). Water levels will be recorded before evacuating each well for sample collection. Groundwater elevation references shall include the top of the well casing and land surface at each well site (NGVD or NAVD) at a precision of plus or minus 0.01 foot. Monitoring wells will be purged prior to sampling to obtain representative samples. Analyses will be conducted on unfiltered samples, unless filtered samples have been approved by the FDEP's Northeast District Office as being more representative of groundwater conditions.

3.5.2 Parameters and Frequency

Groundwater samples from C-1 through C-7 and B-1 through B-4 will be analyzed by a certified laboratory that meets the requirements of Chapter 62-160, F.A.C. and minimum analytical detection limits will be at or below the groundwater standards and/or criteria. Groundwater samples from C-1 through C-7 and B-1 through B-4 will be analyzed for the following:

Parameter	Units	Sample Type	Monitoring Frequency
Water Level (NGVD)	Feet	In-situ	Semi-Annual
pH (field)	SU	In-situ	Semi-Annual
Specific Conductance (field)	µmhos/cm	In-situ	Semi-Annual

Parameter	Units	Sample Type	Monitoring Frequency
Dissolved Oxygen (field)	mg/L	In-situ	Semi-Annual
Aluminum, Total Recoverable	µg/L	Grab	Semi-Annual
Arsenic, Total Recoverable	µg/L	Grab	Semi-Annual
Barium, Total Recoverable	µg/L	Grab	Semi-Annual
Beryllium, Total Recoverable	µg/L	Grab	Semi-Annual
Cadmium, Total Recoverable	µg/L	Grab	Semi-Annual
Chromium, Total Recoverable	µg/L	Grab	Semi-Annual
Copper, Total Recoverable	µg/L	Grab	Semi-Annual
Iron, Total Recoverable	µg/L	Grab	Semi-Annual
Lead, Total Recoverable	µg/L	Grab	Semi-Annual
Mercury, Total Recoverable	µg/L	Grab	Semi-Annual
Nickel, Total Recoverable	µg/L	Grab	Semi-Annual
Selenium, Total Recoverable	µg/L	Grab	Semi-Annual
Vanadium	µg/L	Grab	Semi-Annual
Temperature (field)	Celsius	In-situ	Semi-Annual
Turbidity (field)	NTU	In-situ	Semi-Annual
Sulfate	mg/L	Grab	Semi-Annual

Additionally, once every five years SJRPP will conduct an expanded sampling of existing monitoring wells MW-B4 and MW-C3, for the primary and secondary drinking water parameters included in Chapter 62-550, F.A.C., Tables 1, 4, 5 and 6, (excluding asbestos and pesticides). Analytical results from this expanded sampling will be submitted to the DEP's Northeast District Office within 90 days following the sample event.

If the FDEP determines that the monitoring results for the parameters listed in this GMP indicate an abnormally increasing trend in any of the compliance wells or intermediate wells, the JEA shall meet with the FDEP to discuss and formulate a plan for additional assessment and monitoring, if necessary.

3.6. **Reporting**

A semi-annual report documenting the Industrial Waste Water Monitoring Areas will be submitted to the FDEP and include the following:

- groundwater sampling field notes;
- monitoring results; and

- analytical data received from the laboratory. Subsequent reports will include the above-listed information, with the exception of well construction logs. Groundwater monitoring reports will be submitted to FDEP within 90 days of receipt of analytical data from each semi-annual sampling event.

Sample Period	Semi-Annual	Report Deadline
(January - June)	X	July 28 th
(July - December)	X	January 28 th

Correspondence, reports, plans, and summaries pertaining to ground water monitoring will be submitted to the DEP's Northeast District Office with copies to the DEP's Siting Office in Tallahassee.

4. SOLID WASTE GROUNDWATER MONITORING PLAN

4.1 Introduction

The section presents the Solid Waste GMP for the SJRPP and encompasses the Area I, Area II, and Area B Landfills (**Figure 2**). This section summarizes the site-specific geology and hydrogeology, water quality, monitoring well network, parameters, and sampling frequency for each Monitoring Area.

4.2 Monitoring Area Geology

Based on a lithologic log from monitoring well L-2 (located to the northeast of Area I Landfill), as documented in JEA's *Groundwater Monitoring Well Program, Design and Location Information* Report, the following stratigraphy is representative of conditions in the northern portion of the SJRPP near the Area I, Area II, and Area B Landfills:

- dense brown to dark brown silty sand was documented from approximately 3 to 22-ft bls;
- firm grey slightly clayey fine sand was documented from approximately 22 to 32-ft bls;
- very dense grey sand with blue-green clay seams was documented from 32 to 42-ft bls;
- very dense grey brown medium sand was documented from 42 to 60-ft bls; and
- very dense interbedded tan shelly with trace quartz sand was documented from 60 to 85-ft bls.

4.3 Hydrogeology

4.3.1 Area I Landfill

Groundwater elevations in the intermediate zone (approximately 13 to 46-ft bls) and deep zone (approximately 70 to 85-ft bls) have been recorded quarterly since 1995 in monitoring wells (L-1 through L-3 and L-7 through L-12) located on the perimeter of the Area I Landfill. Based on 2010 groundwater elevation data, groundwater flow in the intermediate zone of the surficial aquifer is generally towards the southeast, as illustrated in **Figure 9** and **Figure 10**. Groundwater flow in the deep zone of the surficial aquifer is generally towards the southeast, as illustrated in **Figure 9** and

Figure 10. Based on the April and October 2010 data, the groundwater flow direction in the intermediate and deep zones is consistent during the spring and fall.

4.3.2 Area II Landfill

Groundwater elevations in the intermediate zone (approximately 20 to 30-ft bls) of the surficial aquifer have been recorded quarterly since 2000 in monitoring wells (L-4 through L-6, and L-16) located along the perimeter of the Area II Landfill. Monitoring wells L-18 through L-26 were installed as part of the Area II Landfill Closure; therefore historic groundwater data is not available at this time. Based on 2010 groundwater elevation data, groundwater flow in the intermediate zone of the surficial aquifer is generally to the south as illustrated in **Figure 11** and **Figure 12**. Based on the April and October 2010 data, the groundwater flow direction is consistent during spring and fall; however the southeastern component appears to be more significant throughout the Area II Landfill during the spring (April 2010).

4.3.3 Area B Landfill

Groundwater elevations in the intermediate zone (approximately 40 to 50-ft bls) of the surficial aquifer have been recorded monthly during 2008 and quarterly since 2009 in monitoring wells (MW-1 through MW-9, MW-A1, and MW-B1) located on the perimeter of the Area B Landfill. Based on 2010 groundwater elevation data, groundwater flow in the intermediate zone of the surficial aquifer is generally from the northwest to east with southeastern compounds, as illustrated in **Figure 13** and **Figure 14**. During the spring (April 2010) the southeastern groundwater flow direction was more significant.

4.4 Groundwater Monitoring Area Network

4.4.1 Area I Landfill

Nine monitoring wells (L-1, L-2, L-3, and L-7 through L-12) comprise the groundwater monitoring network for the Area I Landfill. Three monitoring wells (L-1, L-2, and L-3) are up-gradient of the Area I Landfill and six monitoring wells (L-7 through L-12) are down-gradient of the Area I Landfill with L11 and L12 at the Northeast corner of the landfill area.

The ZOD for the Area I Landfill is defined as extending to a depth of 90 feet below the Area I Landfill at a horizontal distance of 200 feet from the Area I Landfill. Therefore based on the ZOD definition and in accordance with Rule 62-520, L-1 through L-3 are designated as Background Monitoring Wells because they are located up-gradient of

the Area I Landfill and L-7 through L-12 are designated as Intermediate Monitoring Wells because they are located within the Area I Landfill ZOD.

Well construction details for monitoring wells associated with the Area I Landfill are provided in **Table 1**. Geographical coordinates and designations for monitoring wells associated with the Area I Landfill are provided in **Table 2**.

4.4.2 Area II Landfill

Fourteen monitoring wells (L-B, L-4, L-5, and L-16 through L-26) comprise the groundwater monitoring network for the Area II Landfill. Three monitoring wells (L-B, L-4, and L-17) are up-gradient of the Area II Landfill and nine monitoring wells (L-18 through L-26) are down-gradient of the Area II Landfill.

The ZOD for the Area II Landfill is defined as extending to a depth of 90 feet below the Area II Landfill at a horizontal distance of 200 feet from the Area II Landfill. Therefore based on the ZOD definition and in accordance with Rule 62-520, L-B, L-4, L-5, and L-17 are designated as Background Monitoring Wells because they are located up-gradient of the Area I Landfill; L-16, L-18, and L-19 are designated as Intermediate Monitoring Wells because they are located within the Area II Landfill ZOD; and L-20 through L-26 are designated as Compliance Monitoring Wells because they are located down-gradient of the Area II Landfill and outside the ZOD.

Well construction details for monitoring wells associated with the Area II Landfill are provided in **Table 1**. Geographical coordinates and designations for monitoring wells associated with the Area II Landfill are provided in **Table 2**.

4.4.3 Area B Landfill

Twelve monitoring wells (MW-1 through MW-9, MW-20, MW-A1, and MW-B1) comprise the groundwater monitoring network for the Area B Landfill. Nine monitoring wells (MW-1 through MW-6, MW-A1, MW-B1, and MW-20) are up-gradient of the Area B Landfill and three monitoring wells (MW-7, MW-8, and MW-9) are down-gradient of the Area B Landfill.

The ZOD for the Area B Landfill is defined as extending to a depth of 90 feet below the Area B Landfill at a horizontal distance of 200 feet from the Area B Landfill. Therefore based on the ZOD definition and in accordance with Rule 62-520, MW-1 through MW-6, MW-A1, MW-B1, and MW-20 are designated as Background Monitoring Wells because they are located up-gradient of the Area B Landfill; and MW-7, MW-8, and MW-9 are designated as Intermediate Monitoring Wells because they are located within the Area B Landfill ZOD.

Well construction details for monitoring wells associated with the Area B Landfill are provided in **Table 1**. Geographical coordinates and designations for monitoring wells associated with the Area B Landfill are provided in **Table 2**.

4.5 Groundwater Monitoring Parameters and Frequency

4.5.1 Groundwater Sampling

Groundwater samples will be collected from Area 1 Landfill monitoring wells including, L-1 through L-3 and L-7 through L-12, Area II Landfill monitoring wells including, L-B, L-4, L-5, L-16, and L-17 through L-26, and Area B Landfill monitoring wells including MW-1 through MW-9, MW-20, MW-A1, and MW-B1 in accordance with FDEP's Standard Operating Procedures Manual for Field Sampling, and shall conform to the applicable Quality Assurance/Quality Control requirements of Chapter 62-160, F.A.C. (SOPs). Water levels will be recorded before evacuating each well for sample collection. Groundwater elevation references shall include the top of the well casing and land surface at each well site (NGVD and NAVD) at a precision of plus or minus 0.01 foot. Monitoring wells will be purged prior to sampling to obtain representative samples. Analyses will be conducted on unfiltered samples, unless filtered samples have been approved by the FDEP's Northeast District Office as being more representative of ground water conditions.

4.5.2 Parameters and Frequency

Groundwater samples from Area 1 Landfill monitoring wells including, L-1 through L-3 and L-7 through L-12, Area II Landfill monitoring wells including, L-B, L-4, and L-17 through L-26, and Area B Landfill monitoring wells including MW-1 through MW-9, MW-20, MW-A1, and MW-B1 will be analyzed by a certified laboratory that meets the requirements of Chapter 62-160, FAC and minimum analytical detection limits will be at or below the groundwater standards and/or criteria. Groundwater samples will be analyzed for the following parameters:

Parameter	Units	Sample Type	Monitoring Frequency
Water Level (NGVD)	Feet	In-situ	Semi-Annual
pH (field)	SU	In-situ	Semi-Annual
Specific Conductance (field)	µmhos/cm	In-situ	Semi-Annual
Dissolved Oxygen (field)	mg/L	In-situ	Semi-Annual
Aluminum, Total Recoverable	µg/L	Grab	Semi-Annual
Arsenic, Total Recoverable	µg/L	Grab	Semi-Annual

Parameter	Units	Sample Type	Monitoring Frequency
Barium, Total Recoverable	µg/L	Grab	Semi-Annual
Beryllium, Total Recoverable	µg/L	Grab	Semi-Annual
Cadmium, Total Recoverable	µg/L	Grab	Semi-Annual
Chromium, Total Recoverable	µg/L	Grab	Semi-Annual
Copper, Total Recoverable	µg/L	Grab	Semi-Annual
Iron, Total Recoverable	µg/L	Grab	Semi-Annual
Lead, Total Recoverable	µg/L	Grab	Semi-Annual
Mercury, Total Recoverable	µg/L	Grab	Semi-Annual
Nickel, Total Recoverable	µg/L	Grab	Semi-Annual
Selenium, Total Recoverable	µg/L	Grab	Semi-Annual
Vanadium	µg/L	Grab	Semi-Annual
Temperature (field)	Celsius	In-situ	Semi-Annual
Turbidity (field)	NTU	In-situ	Semi-Annual
Sulfate	mg/L	Grab	Semi-Annual

4.6. Reporting

A semi-annual report documenting the Solid Waste Monitoring Areas will be submitted to the FDEP and include the following:

- groundwater sampling field notes;
- monitoring results; and
- analytical data received from the laboratory. Subsequent reports will include the above-listed information, with the exception of well construction logs. Groundwater monitoring reports will be submitted to FDEP within 90 days of receipt of analytical data from each semi-annual sampling event.

Sample Period	Semi-Annual	Report Deadline
(January - June)	X	July 28 th
(July - December)	X	January 28 th

Correspondence, reports, plans, and summaries pertaining to ground water monitoring will be submitted to the DEP's Northeast District Office with copies to the DEP's Siting Office in Tallahassee.

5. REFERENCES

- Camp Dresser and McKee and Geosyntec Consultants, *Closure Design Plan Area II Landfill, St. Johns River Power Park*. September 2009.
- Camp Dresser and McKee and Geosyntec Consultants, *Response to First Request for Additional Information, St. Johns River Power Park*. 28 January 2010.
- Fairchild, R.W., 1972. *The Shallow-Aquifer System in Duval County, Florida*. Florida Geological Survey Report of Investigations No. 59.
- FDEP, *First Request for Additional Information, St. Johns River Power Park Area II Landfill Closure*. 12 November 2009.
- FDEP, Conditions of Certification, PA 81-130, Jacksonville Electric Authority, St. Johns River Power Park – Units 1 & 2, dated December 23, 2009.
- Golder Associates, *Stormwater Management System Modifications, St. Johns River Power Park (Area I Landfill)*. 26 May 2009.
- Golder Associates, *Closure Construction Area I Landfill, St. Johns River Power Park*. April 2008.
- Golder Associates, *Area B ByProduct Storage Area Hydrogeological and Geotechnical Site Evaluation, St. Johns River Power Park*. April 2007.
- JEA's *Groundwater Monitoring Well Program, Design and Location Information* Report. Date Unknown.
- JEA's *Selection of Groundwater Monitoring Well Locations for the St. Johns River Power Park*. July 1985.
- Leve, G.W., 1966. *Ground Water in Duval and Nassau Counties, Florida*. Florida Geological Survey Report of Investigations No. 43.
- Phelps, G.G., 1993. *Water Resources of Duval County, Florida*. U.S Geological Survey Water-Resources Investigations Report 93-4130.

TABLES

TABLE 1: WELL CONSTRUCTION DETAILS
JEA St. Johns River Power Park
Jacksonville, FL

WELL NO.	DIAMETER (inches)	WELL DEPTH (ft bls)	SCREEN INTERVAL (ft bls)	TOC ELEVATION (ft - NGVD 1929)	GROUND ELEVATION (ft - NGVD 1929)	COMPLETION DATE	AQUIFER ZONE
INDUSTRIAL WASTEWATER MONITORING AREAS							
Coal and Limestone Storage Area							
C-1	2	44.5	34.5-44.5	14.487	12.487	3/3/1986	Intermediate Surficial
C-2	2	82.5	72.5-82.5	14.320	12.320	2/27/1986	Deep Surficial
C-3	2	43	33-43	14.092	12.092	3/3/1986	Intermediate Surficial
C-4	2	85.5	75.5-85.5	14.316	12.316	2/27/1986	Deep Surficial
C-5	2	45	35-45	15.095	13.095	2/25/1986	Intermediate Surficial
C-6	2	33.5	22.5-33.5	15.086	13.086	3/7/1986	Intermediate Surficial
C-7	2	82.5	72.5-82.5	15.096	13.013	3/5/1986	Deep Surficial
Wastewater Basins							
B-1	2	40.5	30.5-40.5	19.014	14.222	3/19/1986	Intermediate Surficial
B-2	2	37	36-37	19.239	16.031	3/19/1986	Intermediate Surficial
B-3	2	37	36-37	20.526	18.401	3/17/1986	Intermediate Surficial
B-4	2	37	36-37	20.208	18.208	3/18/1986	Intermediate Surficial
SOLID WASTE MONITORING AREAS							
Area I Landfill							
L-1	2	23	13-23	17.668	15.752	3/6/1986	Intermediate Surficial
L-2	2	83.5	63.5-83.5	16.342	14.509	3/6/1986	Deep Surficial
L-3	2	49	39-49	17.884	15.092	3/6/1986	Intermediate Surficial
L-7	2	39.5	29.5-39.5	17.324	15.366	5/19/1986	Intermediate Surficial
L-8	2	41.5	31.5-41.5	17.314	15.397	2/28/1986	Intermediate Surficial
L-9	2	44.5	34.5-44.5	14.741	12.824	3/5/1986	Intermediate Surficial
L-10	2	81	71-81	13.836	12.253	3/10/1986	Deep Surficial
L-11	2	39	29-39	15.134	13.259	3/10/1986	Intermediate Surficial
L-12	2	46.5	36.5-46.5	15.158	13.366	3/11/1986	Intermediate Surficial
Area II Landfill							
L-B	2	18.5	8.5-18.5	26.160	24.160	5/17/1988	Shallow Surficial
L-4	2	29.5	19.5-29.5	26.316	24.316	2/24/1986	Intermediate Surficial
L-16	2	42	32-42	17.711	15.878	3/10/1986	Intermediate Surficial
L-17	2	29.5	19.2-29.2	28.04	25.30	8/10/2011	Intermediate Surficial
L-18	2	15	4.7-14.7	21.24	18.53	8/8/2011	Shallow Surficial
L-19	2	15	4.7-14.7	20.30	17.57	8/8/2011	Shallow Surficial
L-20	2	29.5	19.2-29.2	15.49	12.66	8/8/2011	Intermediate Surficial
L-21	2	29.5	19.2-29.2	15.36	12.66	8/10/2011	Intermediate Surficial
L-22	2	13	2.7-12.7	15.32	12.41	8/8/2011	Shallow Surficial
L-23	2	29.6	19.3-29.3	15.24	12.49	8/9/2011	Intermediate Surficial
L-24	2	29.5	19.2-29.2	22.00	19.25	8/9/2011	Intermediate Surficial
L-25	2	29.5	19.2-29.2	15.30	12.52	8/9/2011	Intermediate Surficial
L-26	2	15.7	5.4-15.4	21.88	19.12	8/8/2011	Shallow Surficial
Area B Landfill							
MW-1	2	52.44	42.44-52.44	17.67	14.95	11/6/2007	Intermediate Surficial
MW-2	2	52.37	42.37-52.37	18.39	15.72	11/7/2007	Intermediate Surficial
MW-3	2	54.28	44.28-54.28	19.36	16.35	11/13/2007	Intermediate Surficial
MW-4	2	46.84	36.84-46.84	16.33	13.90	11/7/2007	Intermediate Surficial
MW-5	2	43.31	33.31-43.31	14.70	12.01	11/8/2007	Intermediate Surficial
MW-6	2	53.50	43.50-53.50	16.01	13.53	3/14/2006	Intermediate Surficial
MW-7	2	54.09	44.09-54.09	17.44	14.82	11/13/2007	Intermediate Surficial
MW-8	2	53.51	43.51-53.51	17.08	14.34	8/25/2009	Intermediate Surficial
MW-9	2	50.89	40.89-50.89	13.86	10.93	11/5/2007	Intermediate Surficial
MW-20	2	52.00	42.00-52.00	20.64	17.81	11/7/2007	Intermediate Surficial
MW-A1	2	53.43	43.43-53.43	15.01	12.46	11/8/2007	Intermediate Surficial
MW-B1	2	43.34	33.34-43.34	14.68	12.10	11/8/2007	Intermediate Surficial

Notes:

1. Data provided by Bruce Kofler, JEA Manager of Environmental Compliance.
2. Geographical coordinates for Area B Landfill are provided in North American Vertical Datum of 1988 (NAVD 88). Survey performed by Putnal & Associates, Inc.
3. Geographical coordinates for MW-17 through MW-26 associated with the Area II Landfill are provided in NAVD 88. Survey performed by Southeastern Surveying and Mapping, Inc. on September 7, 2011.

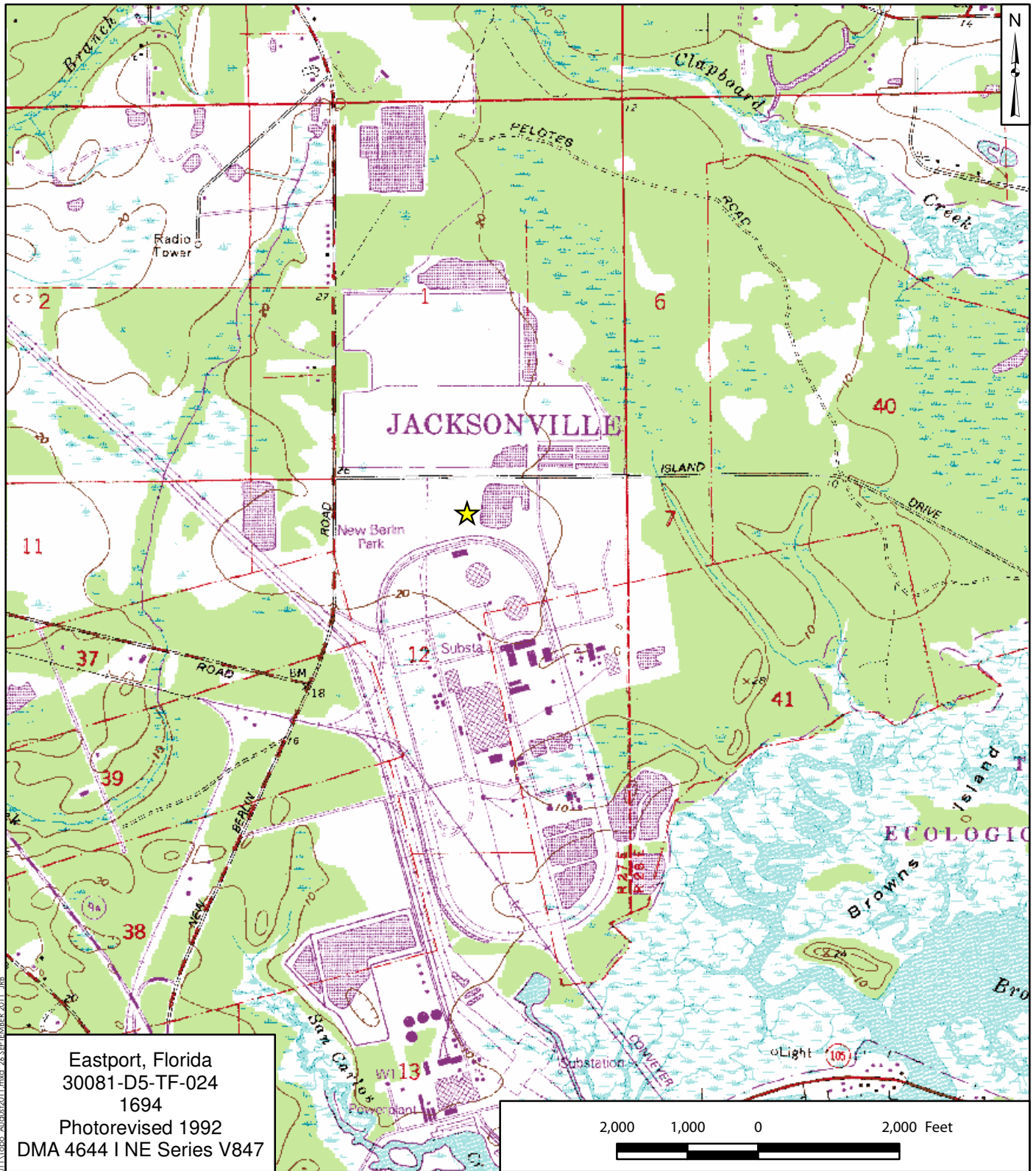
TABLE 2: GEOGRAPHICAL COORDINATES AND WELL DESIGNATIONS
JEA St. Johns River Power Park
Jacksonville, FL

WELL NO.	WELL DESIGNATION	DATE INSTALLED	LONGITUDE	LATITUDE
INDUSTRIAL WASTEWATER MONITORING AREAS				
Coal and Limestone Storage Area				
C-1	Background	3/3/86	-81.55324169270	30.42707127000
C-2	Background	2/27/86	-81.55331132220	30.42711107210
C-3	Intermediate	3/3/86	-81.54628807890	30.42471476500
C-4	Intermediate	2/27/86	-81.54626539180	30.42479505450
C-5	Intermediate	2/25/86	-81.54560198410	30.42614108800
C-6	Intermediate	3/7/86	-81.54586293440	30.42730281830
C-7	Intermediate	3/5/86	-81.54581621900	30.42722281910
Wastewater Basins				
B-1	Intermediate	3/19/86	-81.54863781430	30.43120066860
B-2	Intermediate	3/19/86	-81.54877112700	30.43021772570
B-3	Intermediate	3/17/86	-81.54738480930	30.43054432430
B-4	Intermediate	3/18/86	-81.54793927030	30.43040165770
SOLID WASTE MONITORING AREAS				
Area I Landfill				
L-1	Background	3/6/86	-81.54578847110	30.44093619060
L-2	Background	3/6/86	-81.54560387200	30.44102718120
L-3	Background	3/6/86	-81.54585865180	30.44105371470
L-7	Intermediate	5/19/86	-81.54293847550	30.43395111190
L-8	Intermediate	2/28/86	-81.54301676970	30.43555467590
L-9	Intermediate	3/5/86	-81.54337415370	30.43741770990
L-10	Intermediate	3/10/86	-81.54332732420	30.43731766180
L-11	Intermediate	3/10/86	-81.54396704270	30.44002155930
L-12	Intermediate	3/11/86	-81.54410475430	30.43982049920
Area II Landfill				
L-B	Background	5/17/88	-81.55100718760	30.44104391770
L-4	Background	2/24/86	-81.55108598860	30.44103648790
L-16	Intermediate	3/10/86	-81.55412639680	30.43828907150
L-17	Background	8/10/11	-81.55493818740	30.44097054540
L-18	Intermediate	8/8/11	-81.55331517660	30.43883988280
L-19	Intermediate	8/8/11	-81.55049607360	30.43879223080
L-20	Compliance	8/8/11	-81.55494897860	30.43747232320
L-21	Compliance	8/10/11	-81.55377812550	30.43816159600
L-22	Compliance	8/8/11	-81.55203990010	30.43852538200
L-23	Compliance	8/9/11	-81.55050388710	30.43827597670
L-24	Compliance	8/9/11	-81.54886952660	30.43801013080
L-25	Compliance	8/9/11	-81.55214457310	30.43851718900
L-26	Compliance	8/8/11	-81.54892954000	30.43808298060
Area B Landfill				
MW-1	Background	11/6/07	-81.54826533360	30.45523748020
MW-2	Background	11/7/07	-81.54650763630	30.45237042730
MW-3	Background	11/13/07	-81.54439225330	30.45012447280
MW-4	Background	11/7/07	-81.54293483090	30.44700307660
MW-5	Background	11/8/07	-81.54236694860	30.44510667400
MW-6	Background	3/14/06	-81.54153963800	30.44151076550
MW-7	Intermediate	11/13/07	-81.53884178670	30.44168836080
MW-8	Intermediate	8/25/09	-81.53639255220	30.44249215510
MW-9	Intermediate	11/5/07	-81.53638607670	30.44374959370
MW-20	Background	11/7/07	-81.54303975050	30.44901911030
MW-1A	Background	11/8/07	-81.53759402390	30.44521581020
MW-1B	Background	11/8/07	-81.54048271890	30.44506560490

Notes:

1. Data provided by Bruce Kofler, JEA Manager of Environmental Compliance.

FIGURES

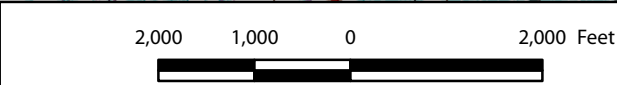


Eastport, Florida
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★ Approximate Subject Site Location

Note:
Source of Eastport, FL USGS 7.5 Minute Quadrangle:
Florida Department of Environmental Protection, Land Boundary
Information System (LABINS)



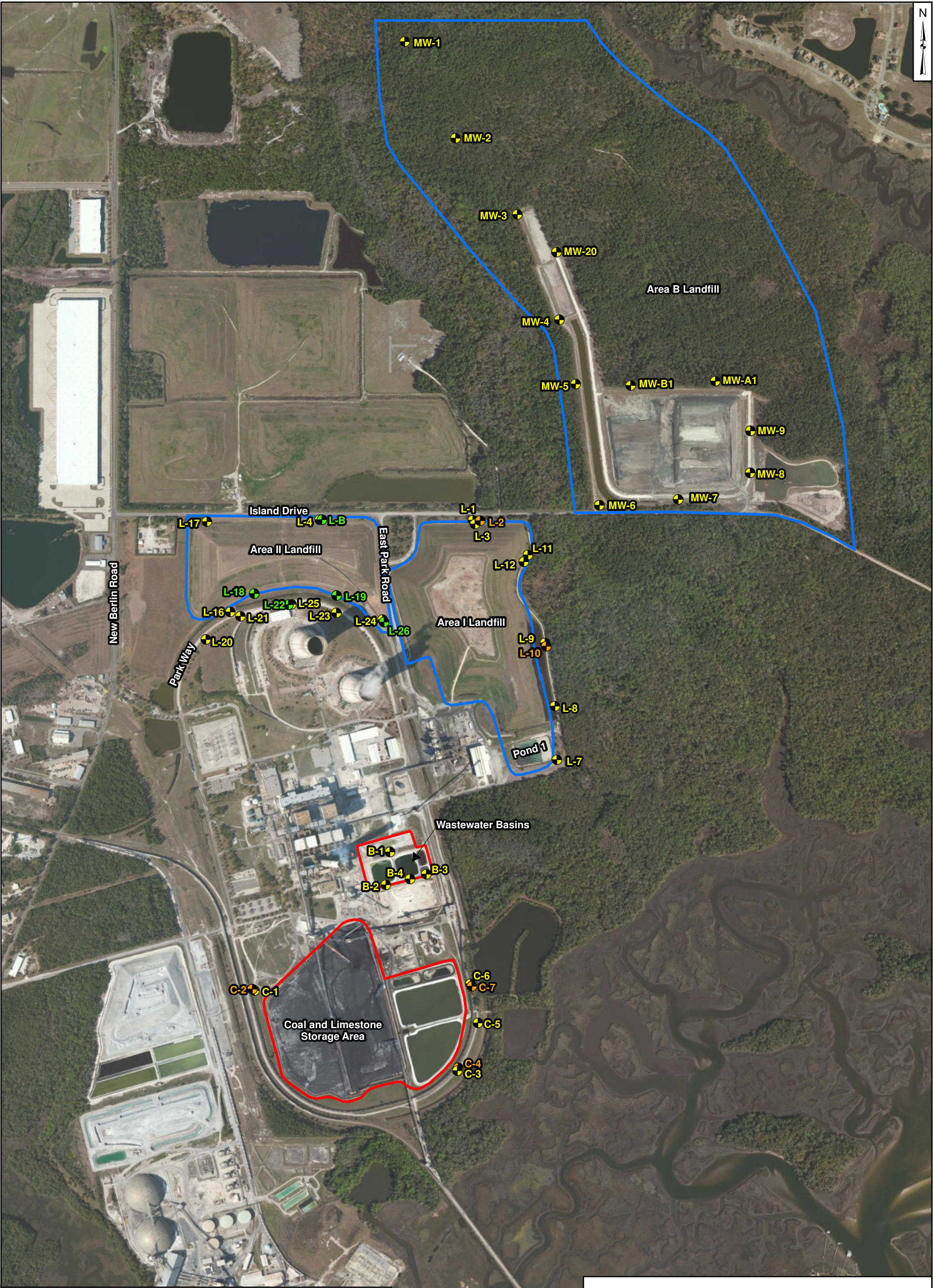
Site Location Map
JEA St. Johns River Power Park
11201 New Berlin Road
Jacksonville, FL

Geosyntec
consultants

Jacksonville, FL September 2011

Figure
1

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Shallow Groundwater Monitoring Well Location

Intermediate Groundwater Monitoring Well Location

Deep Groundwater Monitoring Well Location

Solid Waste Groundwater Monitoring Area (approximate extent)

Industrial Wastewater Groundwater Monitoring Area (approximate extent)

Notes:
1. Monitoring well locations are estimated based on coordinates provided in the "Groundwater Well Map" provided by St. Johns River Power Park (SJRPP) dated 18 July 1996 Rev00.
2. Aerial imagery courtesy of Microsoft Corporation.

1,000

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Feet

Site Map

JEA St. Johns River Power Park
11201 New Berlin Road
Jacksonville, FL

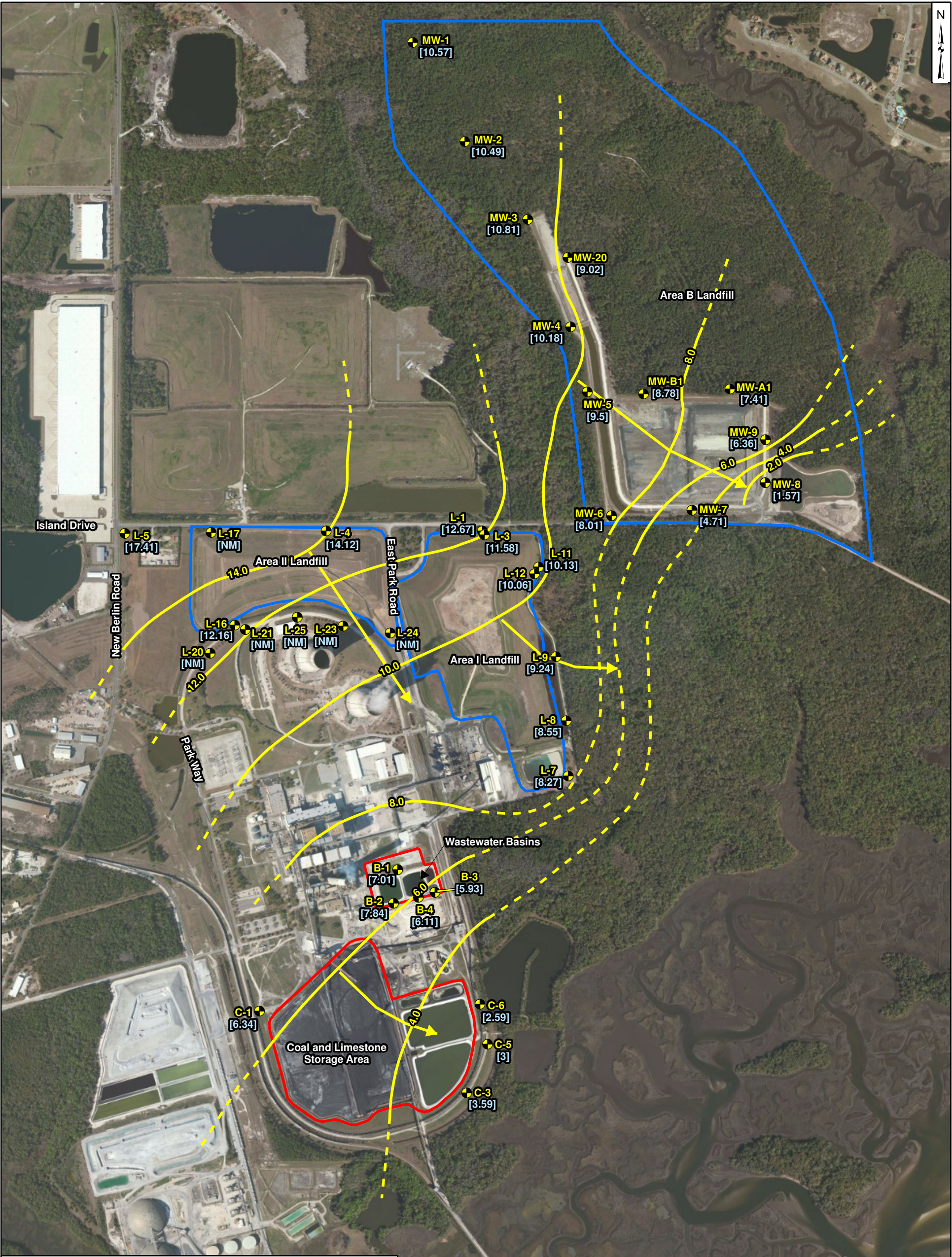
Geosyntec

consultants

Jacksonville, FL

September 2011

Figure
2



Legend

Intermediate Groundwater Monitoring Well Location

Inferred Groundwater Elevation Contour

Groundwater Elevation Contour

Groundwater Flow Direction

Solid Waste Groundwater Monitoring Area (approximate extent)

Industrial Wastewater Groundwater Monitoring Area (approximate extent)

Groundwater Elevation (ft)

Notes:

1. Monitoring well locations are estimated based on coordinates provided in the "Groundwater Well Map" provided by St. Johns River Power Park (SJRPP) dated 18 July 1996 Rev00.

2. NM indicates not measured.

3. Aerial imagery courtesy of Microsoft Corporation.

1,00050001,000 Feet

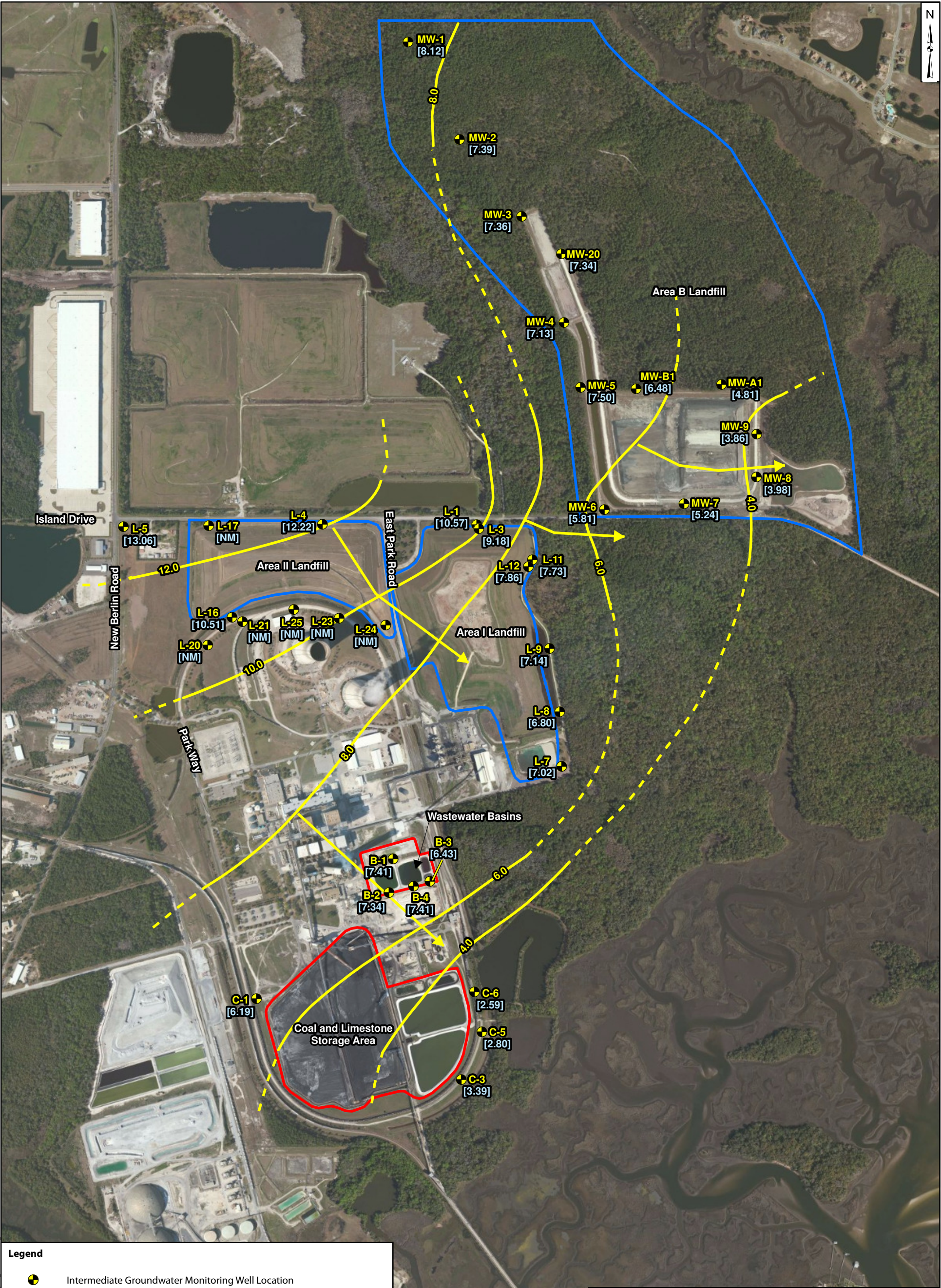
SJRPP Potentiometric Groundwater Map
(April 2010)
JEA St. Johns River Power Park
11201 New Berlin Road
Jacksonville, FL

Geosyntec
consultants

Figure
3

Jacksonville, FL

September 2011



Legend

Intermediate Groundwater Monitoring Well Location

Inferred Groundwater Elevation Contour

Groundwater Elevation Contour

Groundwater Flow Direction

Solid Waste Groundwater Monitoring Area (approximate extent)

Industrial Wastewater Groundwater Monitoring Area (approximate extent)

Groundwater Elevation (ft)

Notes:

1. Monitoring well locations are estimated based on coordinates provided in the "Groundwater Well Map" provided by St. Johns River Power Park (SJRPP) dated 18 July 1996 Rev00.

2. NM indicates not measured.

3. Aerial imagery courtesy of Microsoft Corporation.

1,00050001,000 Feet

SJRPP Potentiometric Groundwater Map
(October - November 2010)
JEA St. Johns River Power Park
11201 New Berlin Road
Jacksonville, FL

Geosyntec
consultants

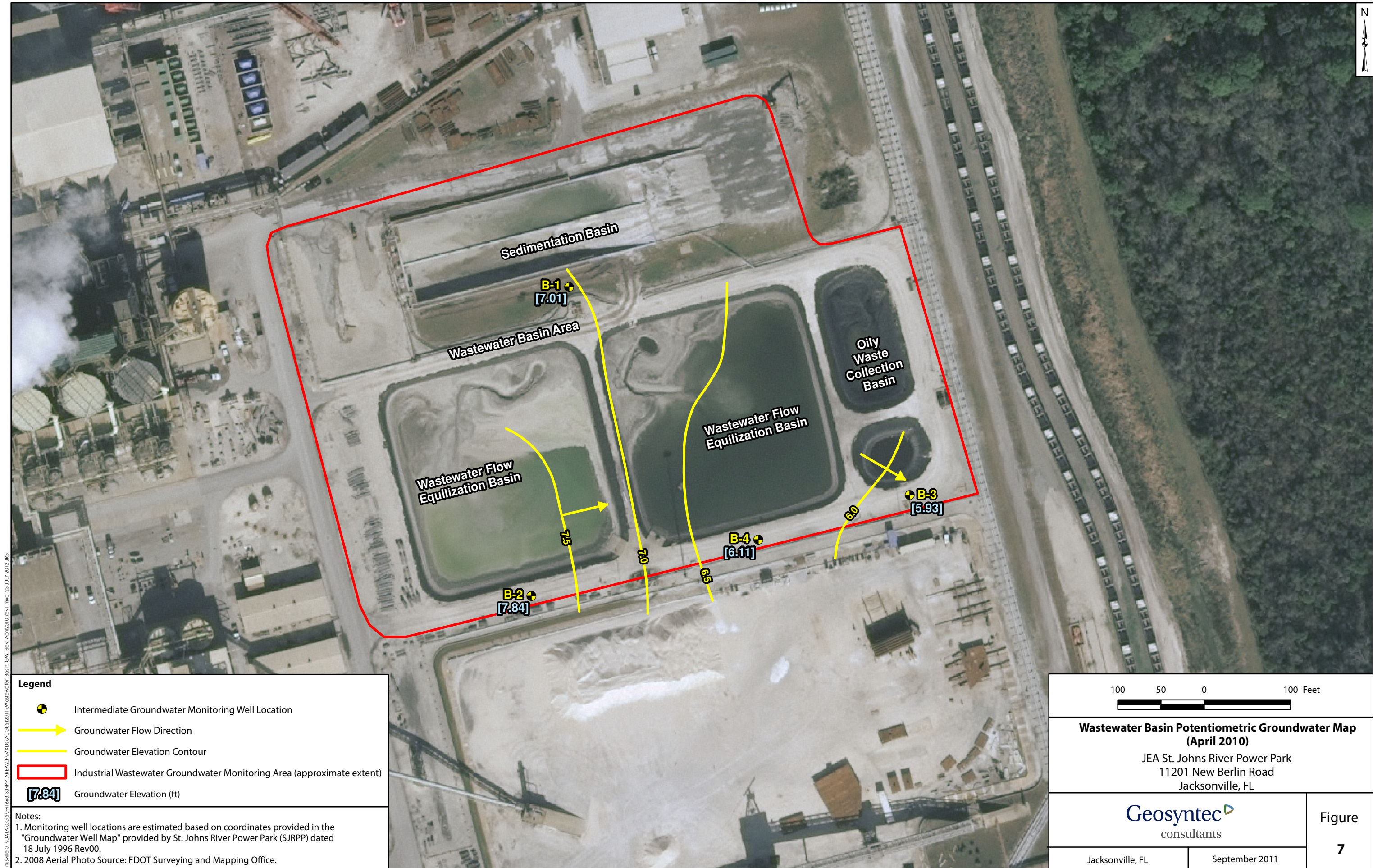
Figure
4

Jacksonville, FL

September 2011







Legend

- Intermediate Groundwater Monitoring Well Location
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Industrial Wastewater Groundwater Monitoring Area (approximate extent)
- [7.84] Groundwater Elevation (ft)

Notes:

- Monitoring well locations are estimated based on coordinates provided in the "Groundwater Well Map" provided by St. Johns River Power Park (SJPPP) dated 18 July 1996 Rev00.
- 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

100 50 0 100 Feet	
Wastewater Basin Potentiometric Groundwater Map (April 2010) JEA St. Johns River Power Park 11201 New Berlin Road Jacksonville, FL	
Jacksonville, FL	September 2011
Figure 7	

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Legend

Intermediate Groundwater Monitoring Well Location

Groundwater Flow Direction

Groundwater Elevation Contour

Industrial Wastewater Groundwater Monitoring Area (approximate extent)

Groundwater Elevation (ft)

Notes:

1. Monitoring well locations are estimated based on coordinates provided in the "Groundwater Well Map" provided by St. Johns River Power Park (SJRP) dated 18 July 1996 Rev00.

2. NM indicates not measured.

3. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

100500100 Feet

Wastewater Basin Potentiometric Groundwater Map
(October 2010)

JEA St. Johns River Power Park
11201 New Berlin Road
Jacksonville, FL

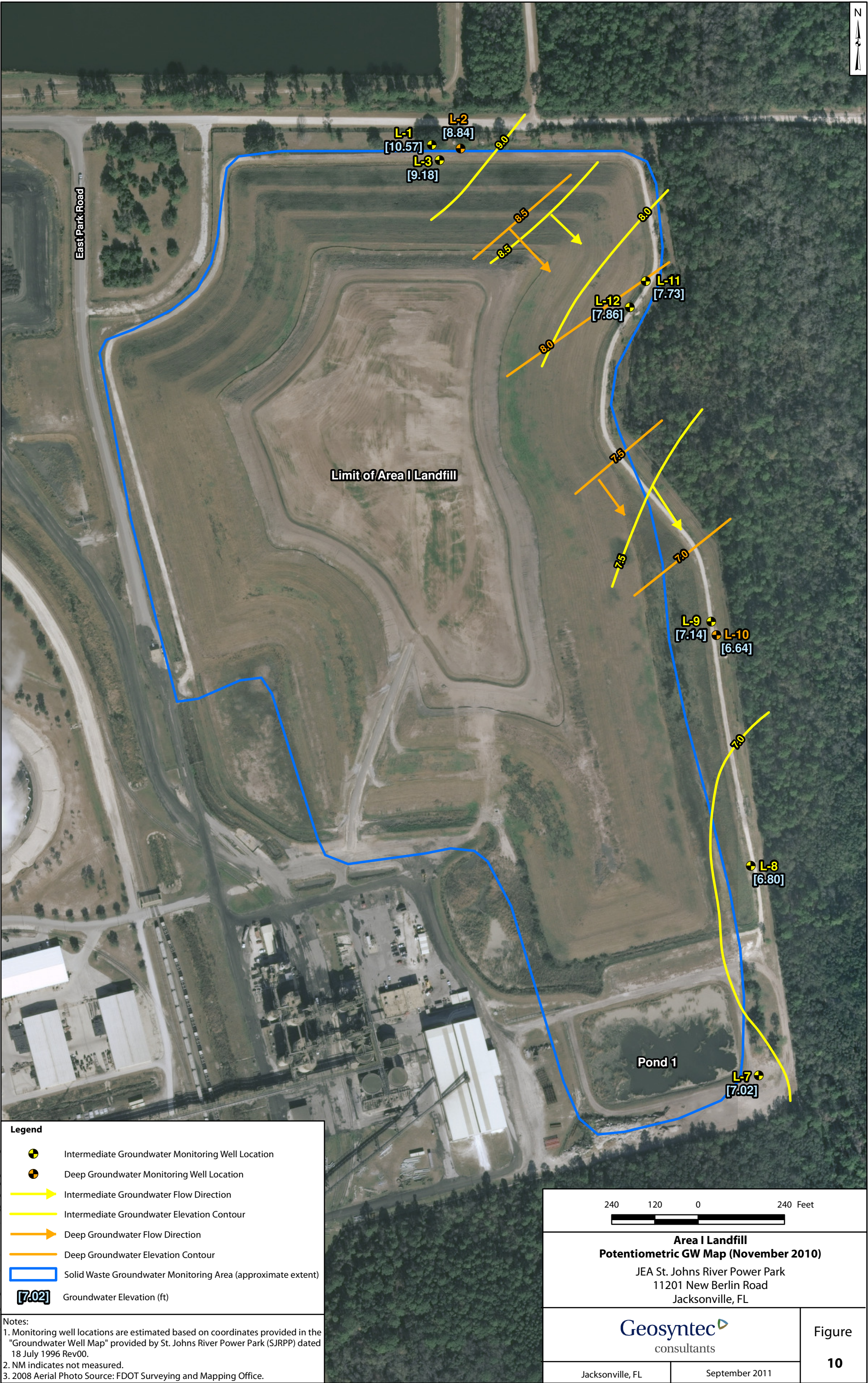
Geosyntec
consultants

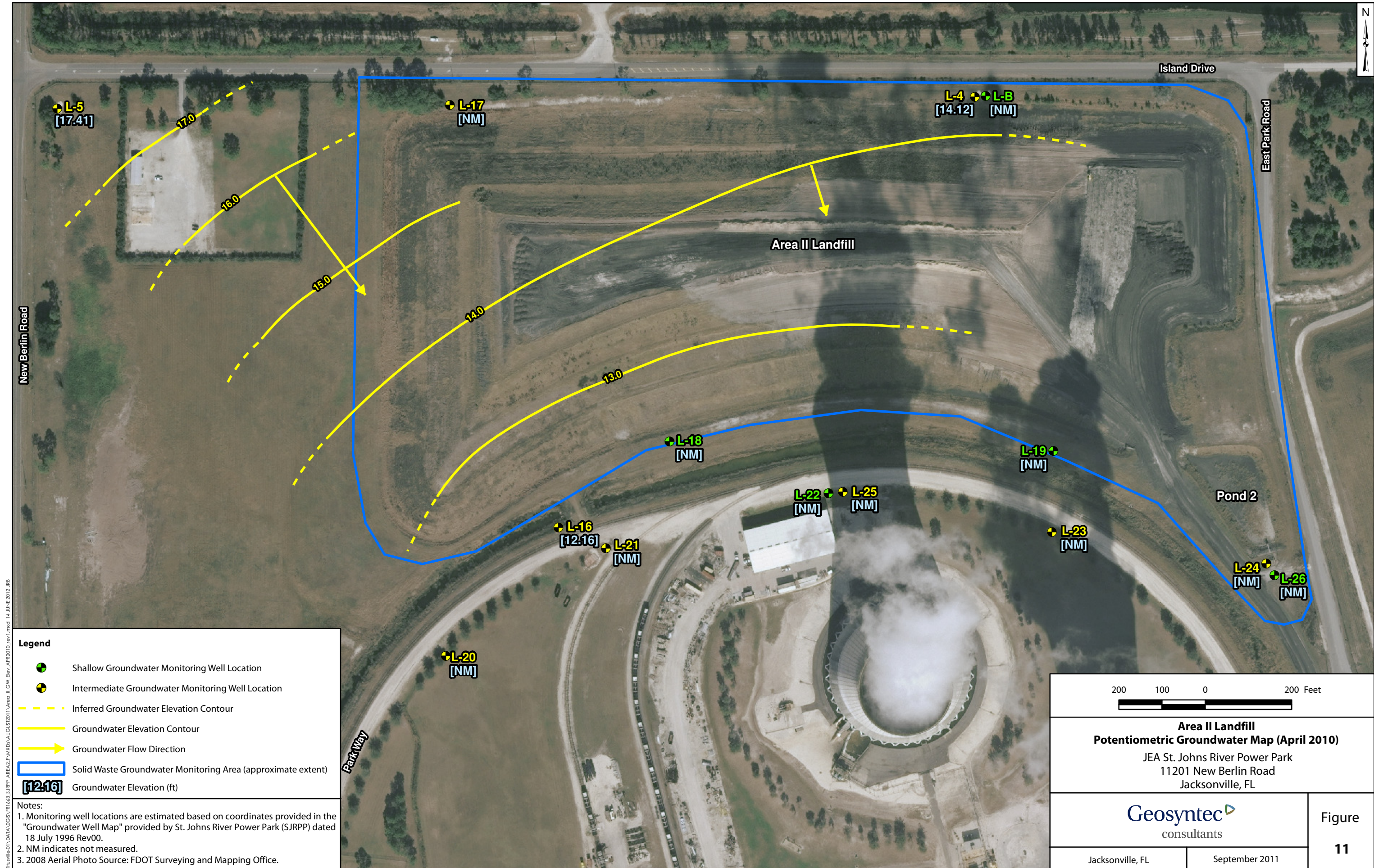
Figure
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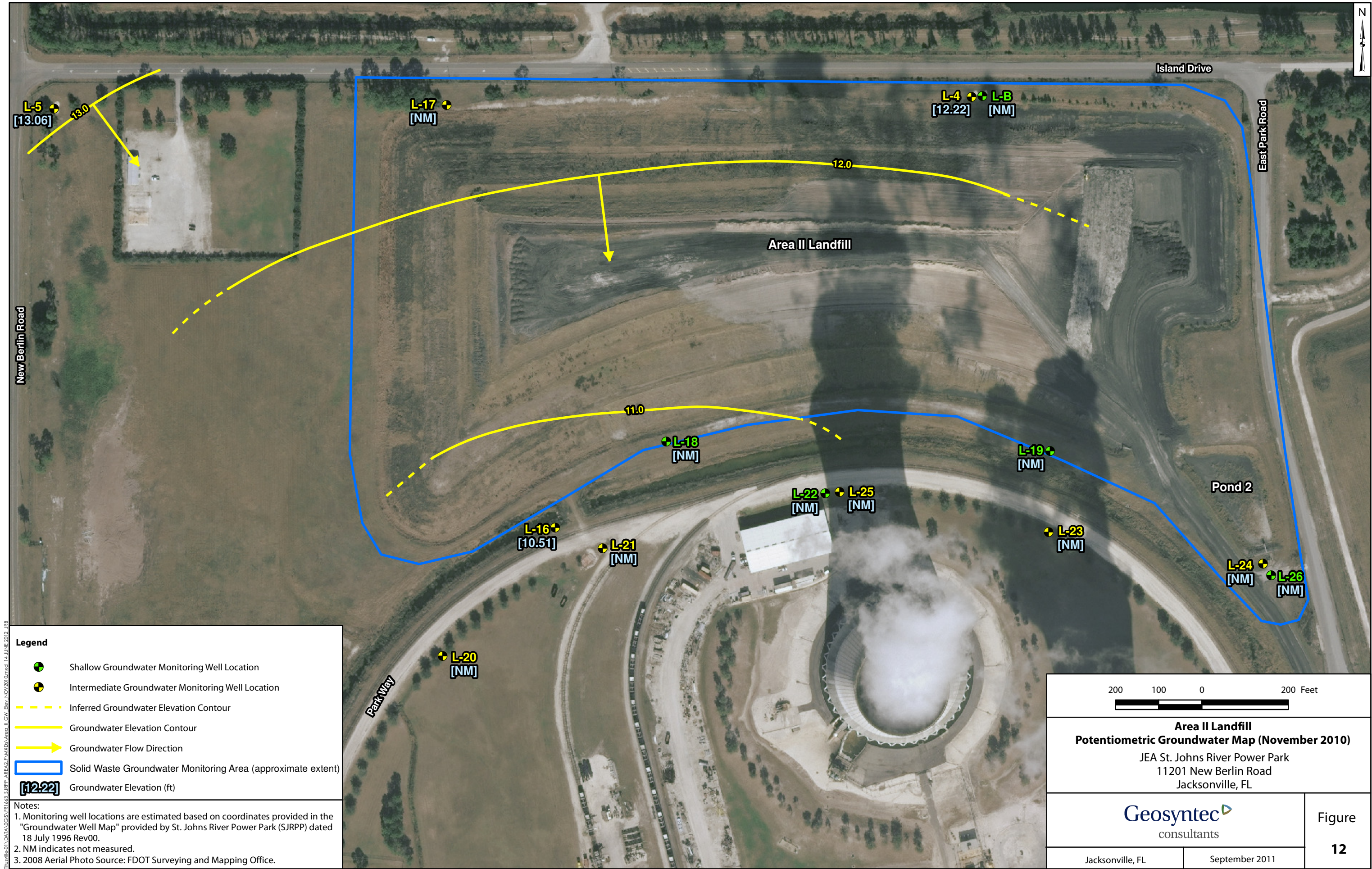
Jacksonville, FL

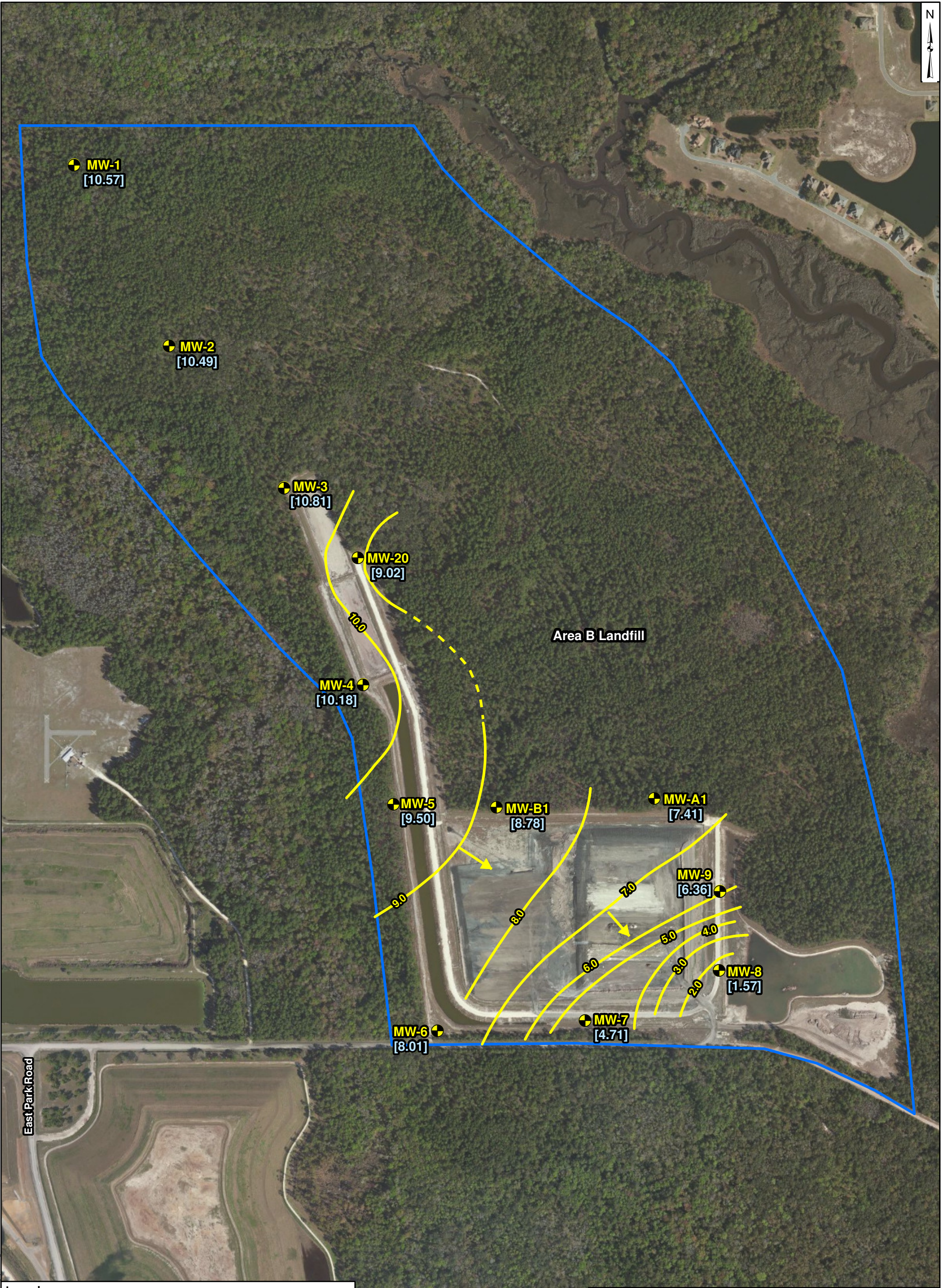
September 2011











Legend

Intermediate Monitoring Well Location

Inferred Groundwater Elevation Contour - April 2010

Groundwater Elevation Contour - April 2010

Groundwater Flow Direction - April 2010

Solid Waste Groundwater Monitoring Area (approximate extent)

Groundwater Elevation (ft)

Notes:

1. Monitoring well locations are estimated based on coordinates provided in the "Groundwater Well Map" provided by St. Johns River Power Park (SJRP) dated 18 July 1996 Rev 0.

2. Aerial imagery courtesy of Microsoft Corporation.

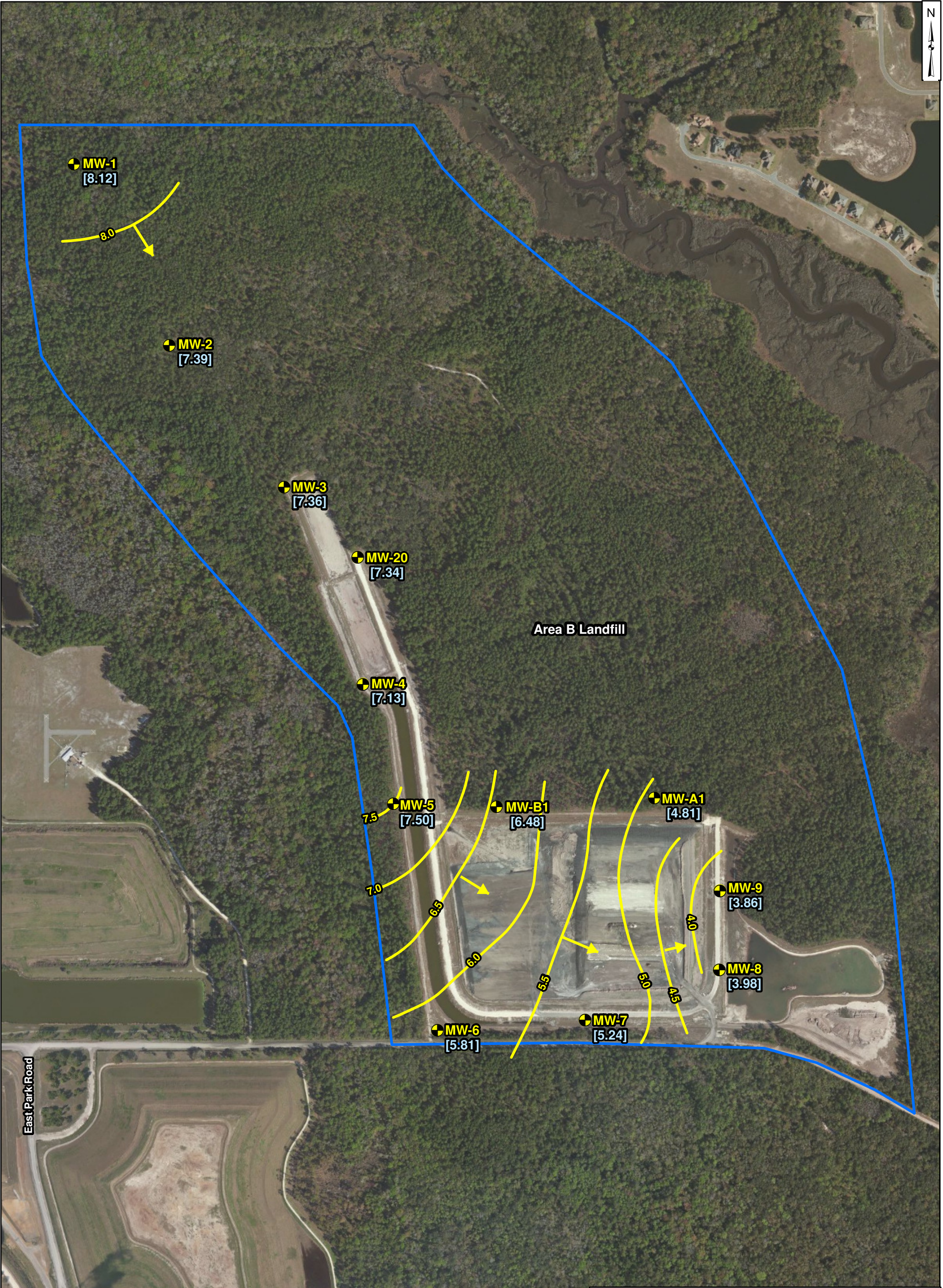
5402700540 Feet

**Potentiometric Groundwater Map
(April 2010)**
JEA St. Johns River Power Park
11201 New Berlin Road
Jacksonville, FL

Figure
13

Jacksonville, FL

September 2011



Legend

Intermediate Monitoring Well Location

Groundwater Flow Direction - October 2010

Groundwater Elevation Contour - October 2010

Solid Waste Groundwater Monitoring Area (approximate extent)

[5.81] Groundwater Elevation (ft)

Notes:
1. Monitoring well locations are estimated based on coordinates provided in the "Groundwater Well Map" provided by St. Johns River Power Park (SJRPP) dated 18 July 1996 Rev00.
2. Aerial imagery courtesy of Microsoft Corporation.

5402700540 Feet

Potentiometric Groundwater Map
(October 2010)
JEA St. Johns River Power Park
11201 New Berlin Road
Jacksonville, FL

Geosyntec
consultants

Figure
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Jacksonville, FL

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