

## **EXPERT OPINION REPORT**

**Dr. Ricardo N. Calvo**

**Dr. Robert Langstroth**

**Environmental Resources Management**

**28 July 2016**

### **Purpose and Scope**

1. Vinson & Elkins RLLP (V&E) engaged Drs. Ricardo N. Calvo and Robert Langstroth, of Environmental Resources Management (ERM), as expert witnesses to provide an independent assessment of the environmental conditions of the Las Olas project site and the expert report of Costa Rica's expert witness Kevin Erwin (KECE), with particular emphasis on the following:
  - a. The classification of wetlands under Costa Rican law;
  - b. Whether the Las Olas project site contains, or has ever contained, wetlands protected by Costa Rican law;
  - c. The classification and identification of trees and forests that are protected by Costa Rican law; and
  - d. Whether the Las Olas project site contains, or has ever contained, a forest or other trees that are protected by Costa Rican law, and if it has, whether the Investors caused any harm or violated any laws with respect to those protected trees or forests.
2. Further clarification of the engagement discussed with Mr. Landicho of V&E focused our efforts on establishing the presence of wetlands and forest on site. We do not comment or rely on any of the many existing reports prepared by others. We do not comment on the legal case.
3. Drs. Calvo and Langstroth reviewed selected documentation on the case as well as publicly available literature. Dr. Calvo visited the site on July 6 and 7 and reviewed all the areas identified in the KECE report as potential wetlands. Dr. Calvo also traversed the majority of the site to gather observations regarding potential forests on site.

### **General site conditions**

#### **Location and Surroundings**

4. The Las Olas project site is an approximately 38-ha parcel located in the small town of Esterillos Oeste, Provincia de Puntarenas, along the Pacific coast of Costa Rica (Figure 1).

5. The site is bounded on all sides by roads, including Route 34, a main thoroughfare connecting towns along the Pacific coast in the Provincia of Puntarenas, on the north. Residential developments are located to the east, west, and south of the site.
6. The Asserradero Estuary, formed by the outflow of the Aserradero Creek, is located just east of the site.
7. Along this portion of the Pacific Coast of the Provincia of Puntarenas, there are multiple tourist developments, such as hotels, resorts, and condominiums, which provide access to several kilometers of continuous beach.
8. Development in the general vicinity of the Las Olas project site is concentrated along the coast line. To the north of Route 34, land use appears to be primarily a mosaic of cattle grazing and small scale agriculture.

#### **Recent Site History Based on Available Aerial Photography**

9. Based on aerial photography available through Google Earth, the Las Olas site was under cattle grazing use in 2002 (Figure 2). The site is covered by herbaceous vegetation, with scattered trees located primarily in the southcentral portion of the site and along property fence lines on the south.
10. The photo from 2012 suggests that cattle grazing had ceased on site and, therefore, tree cover had increased on site (Figure 3). This is to be expected in lowland tropical habitats with high rainfall, such as the Las Olas site. From conversations with a local resident, Mr. Francisco Mora, we understand that after the investors acquired the property in 2002, they decided to stop cattle grazing on the site.
11. The photo from 2016 shows a similar distribution of tree cover as in 2012, as well as indications of squatting activity on site (Figure 4).

#### **Current conditions**

12. At the time of Dr. Calvo's visit on July 6 and 7, the site is a mix of open areas (dominated by herbaceous vegetation) and secondary growth areas (dominated by trees).
13. Squatters have placed simple barbed-wire fencing throughout much of the site. Primitive shelters are scattered throughout the site and at least three wooden houses have been built in the southcentral portion of the site. Plantain or banana and other crops are evident in many of the fenced areas.

### **Are there wetlands on site?**

#### **Topography and high precipitation determine hydrologic regime on site**

14. Annual precipitation in the Esterillos Oeste area is approximately 3,000 mm (<http://en.climate-data.org/location/206463/>). As a reference, this annual precipitation is nearly double that of Florida and almost three times as high as in the District of Columbia.
15. Based on precipitation and temperature, the Las Olas project site falls within the Humid to Very-humid Pre-montane Forest category in the widely used Holdridge Classification of Life Zones (Solano y Villalobos, undated).
16. Based on the 2008 topographic map of the site, prepared by Arquitectos SO+ Mussio Madrigal, and field observations, the topography of the site shows elevations between 36 meters above sea level (masl) in the central portion of the site and 2 masl in the southeastern corner of the site. There is a series of small hills mainly on the north and central portions of the site. Moderate slopes into lower areas create natural drainage features on the north, east, south and west of the site. (Note: the topographic map incorrectly shows Quebrada Aserradero traversing the east portion of the site. Here we refer to the topographical map only as a general reference of the topographic characteristics of the site, but did not use it for our analysis).
17. Rain water on the site drains through a series of culverts that allow water to flow under the roads that surround the site.
18. There are three shallow depressions on site (Figure 5). Two are located along its western boundary and one on its northern boundary, just west of an existing house located in a parcel that does not belong to the Las Olas site. At the time of the visit, these three areas had up to 20-30 cm of standing water (for example, see Photo 1).



Photo 1 - Standing water in depressional area on July 6, 2016

19. The southwest corner of the site is a gently sloping area, with elevations decreasing from adjacent hills of more than 20 masl toward the south portion of the area at about 10 masl. Mr. Francisco Mora said that, before the current stormwater drainage system was built by the municipality, the water from this portion of the site used to flow southward, following the 10 m contour out of the site and straight down the road until it discharged into the ocean.
20. Currently, water draining from this southwest corner of the site is collected in a drainage structure located just south of the site and diverted eastward, along the existing road, until it discharges into a tributary of the Aserradero estuary.

### **Vegetation and Soils**

21. Observations of the vegetation composition focused on the areas identified by KECE as potential wetlands.
22. The three shallow depressions on the west site of the site, which had standing water on July 6, are dominated by the grass *Paspalum fasciculatum* (Mexican crownggrass) and show the typical physiognomy (form) of a depressional freshwater marsh.

23. In these three areas, the extent of flooding matched the extent of the Mexican crowngrass dominated vegetation, with a sharp edge where the vegetation abruptly changes to a mix of shrubs and trees (Photo 2).



Photo 2 - Sharp vegetation edge indicating the boundary of flooding

24. In the southwest corner of the site, where the site gently slopes toward the south, the vegetation is also dominated by Mexican crowngrass, intermixed with other herbaceous species such as *Mimosa* sp., *Cyperus* sp., and *Arachis* sp. (ground peanut).
25. In other low areas of the site, such as in the southeast corner, moderate slopes allow water to flow fast following the topography. The vegetation is typical of humid tropical areas, including species of *Heliconia* spp. and *Costus* spp.
26. No systematic evaluations of soils were performed on site. Observation of a soil probe in the southwest corner of the site suggests that the soil is not hydric in this area. Soils in the depressional areas may be subject to seasonal or temporary flooding, as observed on July 6.

#### **Other Hydrologic Indicators**

27. With approximately 3,000 mm of annual precipitation, there is evidence of water movement associated with drainage during rain events, particularly in and at the bottom of slopes.



28. Outside the three depressional areas, there are no typical indicators of ponding or waterlogging throughout the site.

### **Status of Wetlands on Site**

29. To answer this question for the Las Olas site, we focused on Costa Rica's definitions of wetlands.

30. In Costa Rica, the legal definition of wetlands follows the definition established by the RAMSAR Convention: *"areas of marsh, fen, peat/and or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"*.

31. Article 40 of the Costa Rican Ley Orgánica del Ambiente defines wetlands as *"ecosystems dependent on aquatic regimes, natural or artificial, permanent or temporary, lentic or lotic, freshwater, brackish, or saltwater..."*

32. Decree 35803 of the Ministry of Energy, Environment and Transportation (MINAET) establishes the technical criteria to determine wetlands in Costa Rica.

33. Article 6 of Decree 35803 establishes that the essential ecological characteristics a site must possess to be considered a wetland include a) hydrophilic vegetation, b) hydric soils, and c) hydric conditions. Article 5 of the same decree defines these three characteristics:

- a. Hydric vegetation species grow and develop in aquatic environments. Their life cycle, particularly reproduction, occurs in association with an aquatic medium.
- b. Hydric soils are those that in natural conditions are saturated, flooded or waterlogged. This situation creates anaerobic conditions in the upper portions of the soil. Article 5 also indicates that these soils correspond to Classes VII and VIII in the classification of land use capacity, and are therefore useful as *"zones of flora and fauna preservation, protection of aquifer recharge areas, genetic reserves and scenic beauty"*.
- c. Hydric conditions involve, at minimum, a seasonal abundance of water. The frequency and duration of inundation and saturation varies from permanently flooded to irregularly flooded.

34. Based on field observations and document review, the three depressional areas located on the west side of the Las Olas site show some characteristics of wetlands, as defined in the Costa Rican regulations, however without a soils analysis we cannot confirm whether these are in fact wetlands:

- a. Vegetation: These areas are dominated by species that tolerate wet conditions. However, the dominant species, Mexican crowngrass, grows in a variety of hydric conditions and is not limited to flooded or saturated areas. Its presence by itself is not sufficient to determine that the area is a wetland.
- b. Soils: While no systematic soils analysis was performed, soils in these areas may be subject to seasonal or temporary flooding and saturation.
- c. Hydric conditions: It appears that these three areas are at least temporarily flooded, as they collect runoff from adjacent areas and may be poorly drained. The small area adjacent to Route 34 seems to lack an outlet and, therefore, the water ponds in the depression.

35. The southwestern corner of the site, which we understand is subject to dispute in this case, is not a wetland, as it lacks the ecological characteristics required in Costa Rican law:

- a. Vegetation: This area is dominated by Mexican crowngrass, which has a wide ecological range, along with other herbaceous species which are either upland species or species that tolerate wet conditions, but no flooding or saturation. The dominance of Mexican crowngrass is insufficient to determine that an area is a wetland. Mexican crowngrass grows extensively in tropical countries and is used for cattle grazing.
- b. Soils: While no systematic soil analysis was performed, observations of a soil boring on site, performed by others about a week before Dr. Calvo's visit, did not show hydric soils characteristics.
- c. Hydric conditions: No evidence of ponding or soil saturation was observed. This area drains a large portion of the site and its gentle slope retards runoff. This creates conditions that are wet enough to allow for the establishment of Mexican crowngrass, but not sufficiently wet to develop a truly hydrophilic vegetation composition, nor hydric soils.
- d. Recent site work on the southwest corner of the site included a drainage ditch and other drainage improvements. In our opinion, these improvements collect the surface runoff from the site and direct it orderly to the outside of the site and, ultimately, to the Aserradero estuary.

36. Mexican crowngrass is the dominant species in all the shallow or gently sloped depressions on site. The United States Department of Agriculture maintains a comprehensive list of species which includes the wetland status, if any, of the listed species. Mexican crowngrass is listed as FACW ("facultative wet"), an indicator status that indicates the species *"usually occur in wetlands, but may occur in non-wetlands"*. The designation refers to the Caribbean region,

likely based on this species' preferred habitat in Puerto Rico and other American territories in the Caribbean.

37. In conclusion, the three depressional areas located on the west and northwest sides of the Las Olas site show characteristics of a freshwater marsh and are potentially wetlands under the Costa Rica definition of wetland: 1) dominance of Mexican crowngrass, which in itself does not determine that the area is a wetland, and 2) evidence of seasonal flooding. While no systematic soil analysis was conducted, we believe soils in these depressions are subject to seasonal ponding and saturation and may develop hydric characteristics. However, a soil analysis would be required in order to reach a conclusion.
38. For the rest of this report, we refer to these depressional areas as Depressions 1, 2, and 3 (D1, D2, D3).
39. The southwest corner of the site, while also dominated by Mexican crowngrass, does not show evidence of either hydric condition or hydric soils. Mexican crowngrass, by itself, does not make this area a wetland.
40. Besides depressions D1, D2, and D3, no other potential wetlands occur on the Las Olas site.

#### **Existing Site Plan Considers the Existence of Depressional Areas**

41. We reviewed three blueprints showing different aspects of the site plan, prepared by Arquitectos SO+ Mussio Madrigal.
42. The three blueprints are entitled: a) Site Plan with the Location of Outfalls and Treatment Plants, b) Design of Average Slopes – General Notes, and c) Design of Site Leveling and Terracing – Simbology.
43. Each of these drawings is rendered on top of the 1-m topography of the site.
44. Drawing c) shows the site plan, including open areas at the location of depressions D1 and D3, generally avoiding encroachment into these areas. Depression D2 is outside the development, in the easement area.

#### **Are there forests on site?**

45. To answer this question for the Las Olas site, we focused on Costa Rica's definitions of forest.
46. The Forestry Law of Costa Rica defines a forest ecosystem as “...*diverse plants and animal, major and minor, that interact: are born, grow, reproduce and die, depend on each other throughout their life. After thousands of years, this composition [of species] has reached an*



*equilibrium which, uninterrupted, will remain indefinitely and will sustain transformation very slowly”.*

47. It defines a forest as an *“ecosystem native or auctohtonous, intervened or not, regenerated by natural succession or other forestry techniques, that occupies an area of two or more hectares, characterized by the presence of mature trees of different ages, species and of diverse sizes, with one or more canopy levels that cover more than seventy percent (70%) of the area and where there are more than sixty trees per hectare of fifteen or more centimeters of diameter at breast height (dbh)”.*
48. In paragraphs 9-11 above, we describe the vegetation changes on site since 2002 based on a review of available aerial photography. In the humid tropics, removal of fire and/or grazing typically results in the rapid recruitment of trees and shrubs and, eventually, the development of a forest.
49. Guariguata and Ostertag’s (2001) description of early succession in humid neotropical areas suits the situation at the Las Olas site: *“The first decade of forest succession after site abandonment in the lowland moist and wet Neotropics is characterized by vegetation dominated by grasses, shrubs, and forb, which are eventually shaded out by short-lived, light-demanding “pioneer” tree species, in particular Cecropia, Ochroma, and Solanum and many tree species in the Melastomataceae and Rubiaceae.”* At the Las Olas sites, Dr. Calvo observed *Cecropia*, *Ochroma* and tree species in the Melastomataceae during his visit.
50. Guariguata and Ostertag (2001) propose a conceptual model of forest succession in humid neotropical areas that includes four stages. According to this model, the Las Olas site falls in the “early forest development” stage, which occurs 5-20 years after the site is left untouched, when the area is dominated by short-lived pioneer tree species, and canopy closure begins to occur. The Las Olas site shows patches of trees and, if left untouched, would likely continue the succession sequence.
51. Due to time limitations in the field, we made no attempt to quantify tree density to test the Costa Rica legal definition of “forest”.
52. While we recognize that the site’s natural tendency is to revert to a forested area if left untouched, currently the site is an early successional area with tree patches of different sizes and densities. The site’s tree areas are not connected to a larger system, are not thousands of years old (see definition of forest ecosystem in paragraph 46 above), and are dominated by rapid growing pioneer tree species.
53. In our opinion, the site is not a “forest”. As we did not conduct a quantitative assessment of potential forested areas, we cannot assert whether there are specific patches of 2-ha or more that meet the Costa Rica definition of forest on the Las Olas site.

54. We understand that the dispute involves activities completed in or before 2011, when the site was in an even earlier successional state and the likelihood of occurrence of patches of 2 or more hectares that meet the Costa Rican definition of forest was lower.

### **Comments on KECE's report**

#### **Scope and Methods**

55. KECE's report addresses three scope items:

- a. Provide an independent assessment of the existence and condition of the wetlands and forest on the Claimants' property.
- b. Provide an independent assessment of the impacts on the wetlands and forests on the Claimants' property and the feasibility of their restoration.
- c. Review and comment on Mr. Barboza's 2011 Report on wetlands, 2010 analysis by Minor Arce Solano, 2011 Vegetation Analysis by INGEOFOR, and Mr. Arce's 2012 Statements on the condition of the forest on the Claimants' property.

56. Here, we comment on the portions of KECE's report that directly concern item "a" above.

57. The main body of the report contains 202 numbered paragraphs. Of these, paragraphs 44-49 (six paragraphs) describe the field methodology and GIS mapping of wetlands on site.

58. KECE's methodology to identify wetlands included traversing the site, recording notes, and taking photographs. Paragraph 46 of KECE's report refers to recording observations of hydrologic indicators. Approximate wetland boundaries were delineated apparently using GPS data.

59. There is no specific reference to any methods to assess whether forests are present on site.

#### **KECE's Assessment of the Existence of Wetlands and Forests at the Las Olas Site**

60. KECE's report devotes two paragraphs to the potential existence of forests on site. Paragraph 53 states that the "majority of the site may be considered forested". Paragraph 54 lists some plant species that occur on site. There is no other discussion of how they reach the conclusion that the majority of the site may be considered forested.

61. KECE's report devotes four paragraphs to discussing the wetlands on site.

- a. Paragraph 55 of KECE's report indicates the existence of eight "wetland systems", which were identified "based on KECE's wetland experience" and the three typical parameters

used to determine wetlands: hydrophilic vegetation, hydrologic indicators, and hydric soils.

- b. Paragraph 56 describes the wetlands on site as “palustrine freshwater wetlands (herbaceous and forested) occurring in depressions lower than their immediate surrounding landscape”.
- c. KECE further asserts that these wetlands “are hydrated by rainfall, groundwater seepage and flows from adjacent higher elevations”. There is no discussion about how they determined that groundwater seepage may contribute to the hydration of these areas.
- d. Paragraph 58 of KECE’s report lists some of the species of plants observed in the areas they claim are wetlands.

62. The rest of the report addresses alleged wetland impacts and critiques reports prepared by others.

#### **KECE’s Assessment of the Occurrence of Wetlands and Forests at the Las Olas Site**

63. KECE’s report incorrectly identifies three areas in the east and northeast portion of the site as wetlands. KECE’s Wetlands No. 6, 7, and 8 are not wetlands. These areas are natural drainage features, with moderate slopes, through where precipitation runoff drains to the north and east of the site. In these areas, there is no indication that water remains ponded or soils remain saturated for a long enough time to allow the development of hydric soils or hydrophilic vegetation. Vegetation that occurs in these areas, such as plants in the genera *Costus*, *Heliconia*, and *Calathea* are common in humid areas of the Neotropics, but are not wetland species.
64. KECE’s report incorrectly identifies the southwestern corner of the site as a wetland. Mr Erwin bases his assessment on the dominance of Mexican crowngrass and presence of hydrologic indicators. Mexican crowngrass by itself does not indicate that an area is a wetland, as discussed above. There is no indication of seasonal ponding or saturation. The gentle sloping makes the area be a natural drainage for the site, but the area is not concave enough to allow for ponding. Soils in this area are not hydric.
65. KECE’s report grossly overestimates the extent of potential wetlands on the western portion of the site (KECE’s wetlands 2-5; although KECE’s wetland 4 seems to be outside the site and easements). Above, we discuss the presence of depressional areas that are possibly wetlands, as they seem to meet two of the three parameters. We did not conduct a soil analysis and therefore are not able to determine whether there are hydric soils present. However, the edge of the marsh is clearly the edge of the potential “wetland”, where there is a sharp change of vegetation into an area dominated by trees and shrubs typical of humid neotropical areas

which are not wetland species. KECE seems to have drawn the wetland boundaries along existing topographical lines at the top of the slopes surrounding these depressions. As in the areas on the east of the site, discussed in paragraph 63 above, rainwater quickly flows downhill, preventing sufficient saturation periods to allow for these slopes to develop wetland characteristics.

66. KECE’s report asserts that the majority of the site is forested, but offers no support for this assertion. They did not conduct a quantitative assessment of tree density and dbh, which is necessary to determine if an area meets the Costa Rican definition of forest.

### **KECE’s Assessment of the Wetland Status of Plant Species at the Las Olas Site**

67. KECE’s team identified a total of 97 plant species. Based on Dr. Calvo’s observations on site, we do not dispute this list.
68. Appendix 9 of KECE’s report presents the species list. For each species, they assign an “ecosystem association”, which includes a “wetland” category. There is no indication of where this information was obtained, as there are no references or source attribution. Therefore, we assume the ecosystem association is based on professional opinion. Of the 97 species, 46 are indicated as “wetland”.
69. While we can rely on our extensive experience with neotropical species, we sought to verify the wetland status of KECE’s 46 wetland species in the literature (see Table 1).
70. Many of these species, or closely related species, appear in the United States Department of Agriculture (USDA) wetland indicator database (<http://plants.usda.gov/core/wetlandSearch>). We searched for the wetland indicator for each of the 46 species.
71. The wetland indicator categories are:

#### **Indicator categories**

<b>Indicator Code</b>	<b>Indicator Status</b>	<b>Designation</b>	<b>Comment</b>
OBL	Obligate Wetland	Hydrophyte	Almost always occur in wetlands
FACW	Facultative Wetland	Hydrophyte	Usually occur in wetlands, but may occur in non-wetlands
FAC	Facultative	Hydrophyte	Occur in wetlands and non-wetlands
FACU	Facultative Upland	Nonhydrophyte	Usually occur in non-wetlands, but may occur in wetlands
UPL	Obligate Upland	Nonhydrophyte	Almost never occur in wetlands

72. If a species did not have a wetland status in the USDA database, we attributed it as “not wetland”.
73. For species not in the USDA database, we searched for other readily available sources of information to support its wetland status. Sources are indicated in the table.
74. Our review shows that KECE incorrectly attributed 31 of the 46 species as wetland species. Nearly 70% of the species they call wetland species are not wetland species.

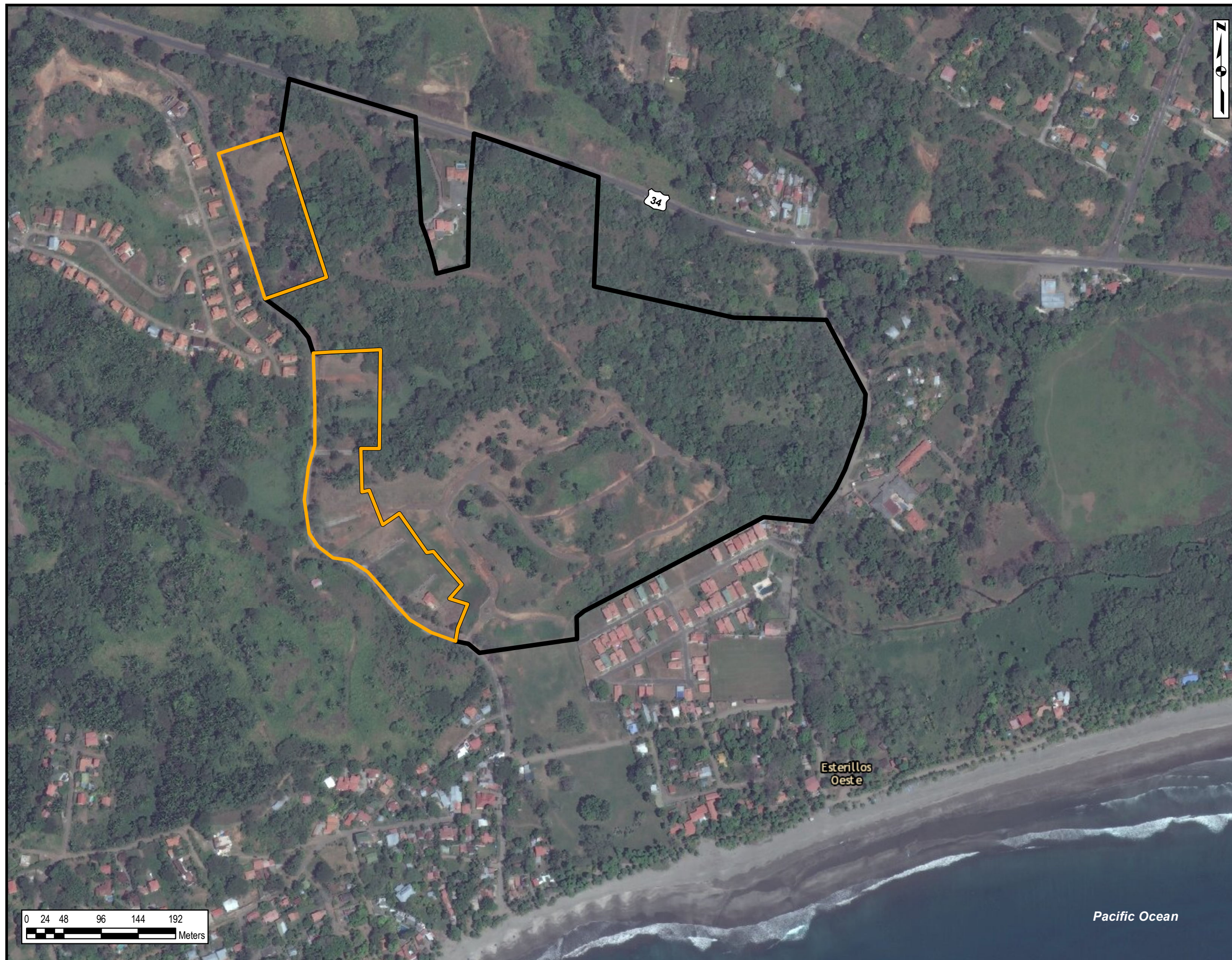
### **Conclusions**

75. The three depressional areas located on the west and northwest sides of the Las Olas site show characteristics of a freshwater marsh: 1) dominance of Mexican crowngrass, which in itself does not determine that the area is a wetland, and 2) evidence of seasonal flooding. While no systematic soil analysis was conducted, we believe soils in these are subject to seasonal ponding and saturation and may develop hydric characteristics. However, a soil analysis would be required in order to reach a conclusion.
76. The southwestern corner of the site, which we understand is subject to dispute in this case, is not a wetland, as it lacks the ecological characteristics required in Costa Rican law.
77. Besides Depressions 1, 2, and 3, no other potential wetlands occur on the Las Olas site.
78. In our opinion, the site is not a “forest”. As we did not conduct a quantitative assessment of potential forested areas, we cannot assert whether there are specific patches of 2-ha or more that meet the Costa Rica definition of forest on the Las Olas site.
79. KECE’s report incorrectly identifies three areas in the east and northeast portion of the site as wetlands. KECE’s Wetlands No. 6, 7, and 8 are not wetlands.
80. KECE’s report incorrectly identifies the southwestern corner of the site as a wetland.
81. KECE’s report grossly overestimates the extent of potential wetlands on the western portion of the site.
82. KECE’s report asserts that the majority of the site is forested, but offers no support for this assertion. They did not conduct a quantitative assessment of tree density and dbh, which is necessary to determine if an area meets the Costa Rican definition of forest.
83. KECE’s report incorrectly denotes 31 of 46 species as wetland species. Nearly 70% of the species the KECE report calls wetland species are not wetland species.

## References

- Guariguata, M.R. and R. Ostertag, 2001. Neotropical secondary forest succession: changes in structural and functional characteristics. *Forest Ecology and Management* 148:185-206.
- Solano, J. and R. Villalobos, undated. Regiones y sub-regiones climáticas de Costa Rica. Instituto Meteorológico Nacional, San José, Costa Rica. 32 pp.





#### Legend

- The Condominium EV Site
- Easements and Other Lots Site

#### NOTES:

1. Aerial Imagery: ESRI World Imagery  
Reproduced under license in ArcGIS 10.4
2. Coordinate System: WGS 1984 UTM Zone 16N

**FIGURE 1:**  
Site Location  
Las Olas, Esterillos Oeste  
Costa Rica  
July 2016







#### Legend

- The Condominium EV Site
- Easements and Other Lots Site

#### NOTES:

1. Aerial Imagery: Google Earth, 2002  
Image copyright 2016 DigitalGlobe  
Image U.S. Geological Survey

**FIGURE 2:**  
Google Earth, 2002 Imagery  
Las Olas, Esterillos Oeste  
Costa Rica  
July 2016







#### Legend

- The Condominium EV Site
- Easements and Other Lots Site

#### NOTES:

1. Aerial Imagery: Google Earth, 2012  
Image copyright 2016 DigitalGlobe

**FIGURE 3:**  
Google Earth, 2012 Imagery  
Las Olas, Esterillos Oeste  
Costa Rica  
July 2016







#### Legend

- The Condominium EV Site
- Easements and Other Lots Site

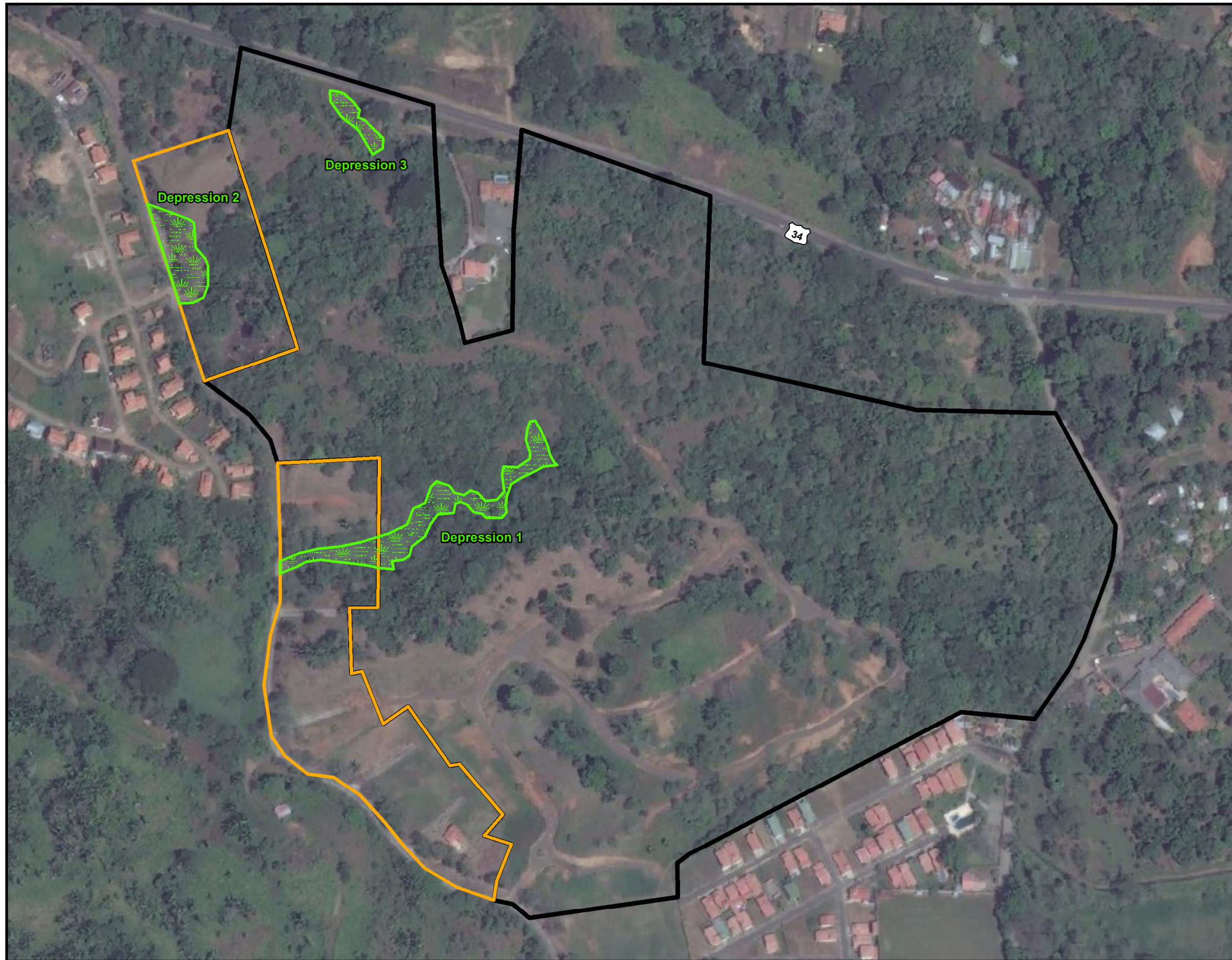
#### NOTES:

1. Aerial Imagery: Google Earth, 2016  
Image copyright 2016 DigitalGlobe




**FIGURE 4:**  
Google Earth, 2016 Imagery  
Las Olas, Esterillos Oeste  
Costa Rica  
July 2016







#### Legend

-  Potential Wetland
-  The Condominium EV Site
-  Easements and Other Lots Site

#### NOTES:

1. Aerial Imagery: ESRI World Imagery  
Reproduced under license in ArcGIS 10.4
2. Coordinate System: WGS 1984 UTM Zone 16N
3. Wetlands/Depressional areas observed  
during ERM's field reconnaissance

**FIGURE 5:**  
Potential Onsite Wetlands  
Las Olas, Esterillos Oeste  
Costa Rica  
July 2016





Table 1 - Review of wetland status of KECE's Appendix 9 species list

Family	Species	Common name	Origin	Biological form	Ecosystem association	IUCN status	USDA wetland status <sup>1</sup>	USDA region	Wetland status - other source	Other source	Notes
Anacardiaceae	<i>Anacardium excelsum</i>	wild cashew, espavé	native	tree	WL; A		FACU	Caribbean	1) <i>Anacardium excelsum</i> is very common in both the Atlantic and Pacific watersheds, from Guatemala to northern South America, including the Guyanas. The tree often dominates on the flood plains and in gallery forests; 2) Common in woods surrounding rivers, running along the riverside.	1) <a href="http://www.rngr.net/publications/tism/species/Anacardium%20excelsum.pdf/at_download/file">http://www.rngr.net/publications/tism/species/Anacardium%20excelsum.pdf/at_download/file</a> 2) <a href="http://biogeodb.stri.si.edu/bocas_database/search/species/3058">http://biogeodb.stri.si.edu/bocas_database/search/species/3058</a>	In USDA database, <i>Anacardium occidentale</i> L.
	<i>Spondias mombin</i>	yellow mombin, jobo	native	tree	WL; A		Not wetland				In USDA database
Araceae	<i>Philodendron</i> spp.		native	herb	WL; A		Not wetland				In USDA database, <i>Philodendron Schott</i>
Arecaceae	<i>Attalea butyracea</i>	Coyol, corozo, palma real	native	palm	WL; A		Not wetland (species: <i>A. funifera</i> )		1) In Panama, common in and characteristic of tropical moist and premontane wet forests; 2) Widespread in Central America and W South America from Mexico to Bolivia, mostly below 300 m elevation. In Ecuador it occurs E of the Andes, often in relatively large stands in flood-plain forest.	1) <a href="http://biogeodb.stri.si.edu/biodiversity/species/18005/">http://biogeodb.stri.si.edu/biodiversity/species/18005/</a> ; 2) <a href="http://www.palmworld.org/view_palms.php?id=197#.V4e2ZE3VxD8">http://www.palmworld.org/view_palms.php?id=197#.V4e2ZE3VxD8</a>	In USDA database, <i>Attalea funifera</i> Mart. ex Spreng.
	<i>Elaeis oleifera</i>	american oilpalm, coquito, corozo, palmiche	native	palm	WL; D		Not wetland				In USDA database, <i>Elaeis oleifera</i> (Kunth) Cortes
Asteraceae	<i>Vernonia patens</i>	tuete	native	shrub	WL; A		FAC	Caribbean	1) lowlands; 2) This species has been identified in the vegetal community of dry forests at the south-west of Ecuador. Generally it can be found near the forest trail and on the edge of the rivers.	1) <a href="http://www.efloras.org/florataxon.aspx?flora_id=40&amp;taxon_id=242432984">http://www.efloras.org/florataxon.aspx?flora_id=40&amp;taxon_id=242432984</a> ; 2) <a href="https://www.researchgate.net/figure/221929489_fig1_Fig-1-Vernonanthura-patens-laritaco-It-grows-wild-in-different-Ecuadorian-areas">https://www.researchgate.net/figure/221929489_fig1_Fig-1-Vernonanthura-patens-laritaco-It-grows-wild-in-different-Ecuadorian-areas</a>	In USDA database, <i>Vernonia horinguensis</i> Urb. Synonym of <i>Vernonanthura patens</i> (Kunth) H. Rob (www.efloras.org)
	<i>Pseudoelephantopus spicatus</i>	dog's-tongue, oreja de burro, oreja de mula	native	herb	WL; A				FACU	<a href="http://florida.plantatlas.usf.edu/Plant.aspx?ID=210">http://florida.plantatlas.usf.edu/Plant.aspx?ID=210</a>	
Bignoniaceae	<i>Crescentia cujete</i>	common calabash tree, jícara	native	tree	WL; F		Not wetland				In USDA database, <i>Crescentia cujete</i> L.
	<i>Tabebuia chrysantha</i>	cortez amarillo	native	tree	WL; F		Not wetland				In USDA database, <i>Tabebuia chrysantha</i> (Jacq.) G. Nicholson
	<i>Tabebuia rosea</i>	pink trumpet-tree, roble de sabana	native	tree	WL; F		Not wetland				In USDA database, <i>Tabebuia rosea</i> (Bertol.) DC.
Bombacaceae	<i>Bombacopsis quinata</i>	pochote	native	tree	WL; A	VU	Not wetland		Found in dry to very dry, or wet tropical forests	<a href="http://www.worldagroforestry.org/treedb/AFTPDFS/Bombacopsis_quinata.PDF">http://www.worldagroforestry.org/treedb/AFTPDFS/Bombacopsis_quinata.PDF</a>	
	<i>Ochroma pyramidale</i>	balsa	native	tree	WL; F		Not wetland				In USDA database, <i>Ochroma pyramidale</i> (Cav. ex Lam.) Urb.
	<i>Pseudobombax septenatum</i>	ceibo barrigón	native	tree	WL; F		Not wetland (species: <i>P. ellipticum</i> )		Humid and dry coastal forest (0-500 m).	<a href="http://www.iucnredlist.org/details/43202/0">http://www.iucnredlist.org/details/43202/0</a>	In USDA database, <i>Pseudobombax ellipticum</i> (Kunth) Dugand



Costaceae	<i>Costus spp.</i>	caña agria	native	herb	WL, D		Not wetland				In USDA database, <i>Costus</i> L.
Cucurbitaceae	<i>Momordica charantia</i>	Balsampear, sorosí, pepinillo	native	vine	WL, A		FAC	Caribbean			
Fabaceae	<i>Andira inermis</i>	abbaque angelin, almendro, almendro de montaña	native	tree	WL; F		FAC	Caribbean			In USDA database, <i>Andira inermis</i> (W. Wright) Kunth ex DC.
	<i>Desmodium incanum</i>	pegapega	native	herb	WL		FACU	Caribbean			In USDA database, <i>Desmodium incanum</i> DC.
	<i>Enterolobium cyclocarpum</i>	guanacaste tree, guanacaste	native	tree	WL; F		Not wetland				In USDA database, <i>Enterolobium cyclocarpum</i> (Jacq.) Griseb.
	<i>Inga ruiziana</i>	guaba	native	tree	WL, A		Not wetland (species: <i>I. nobilis</i> )		Low moist forests.	<a href="http://tropical.theferns.info/vi-ewtropical.php?id=Inga+ruiziana">http://tropical.theferns.info/vi-ewtropical.php?id=Inga+ruiziana</a>	In USDA, database, <i>Inga nobilis</i> L.
	<i>Inga thibaudiana</i>	guaba	native	tree	WL, A		Not wetland (species: <i>I. nobilis</i> )		Secondary forests, margins of paths and riparian forests at low to moderate elevations	<a href="http://tropical.theferns.info/vi-ewtropical.php?id=Inga+thibaudiana">http://tropical.theferns.info/vi-ewtropical.php?id=Inga+thibaudiana</a>	In USDA, database, <i>Inga nobilis</i> Mill.
	<i>Lonchocarpus sp.</i>	chaperno	native	tree	WL, A		Not wetland				In USDA database, <i>Lonchocarpus</i> Kunth
	<i>Mimosa pigra</i>	lollipop mimosa, dormilona grande	native	herb	WL, A		FAC	Caribbean			In USDA database, <i>Mimosa pellita</i> Kunth ex Willd (synonym)
	<i>Schizolobium parahyba</i>	gallinazo	native	tree	WL; F		Not wetland				In USDA database, <i>Schizolobium parahybum</i> (Vell.) S.F. Blake
Flacourtiaceae	<i>Tetrathylacium johansenii</i>	cacao de monte, zapote	native	tree	WL; F				Costa Rica to Colombia. In Panama, known from tropical moist forest in the Canal Zone, San Blas, and Darién and from premontane wet forest in Colón (Santa Rita Ridge).	<a href="http://biogeodb.stri.si.edu/biodiversity/bci/species/32577">http://biogeodb.stri.si.edu/biodiversity/bci/species/32577</a>	
Heliconiaceae	<i>Heliconia latispatha</i>	heliconia	native	herb	WL, A		FACU	Atlantic and Gulf Coastal Plain/Hawaii			
	<i>Heliconia spp.</i>	heliconia	native	herb	WL, A		Not wetland				In USDA database, <i>Heliconia</i> L.
Marantaceae	<i>Calathea lutea</i>	bijagua, platanilla	native	herb	WL, D		FACW	Caribbean			In USDA database, <i>Calathea lutea</i> (Aubl.) Schult.
	<i>Ficus insipida</i>	higuerón	native	tree	WL, A				Common to observe in riparian forests along the course of rivers and streams.	<a href="http://biogeodb.stri.si.edu/bioinformatics/sarigua/species/48">http://biogeodb.stri.si.edu/bioinformatics/sarigua/species/48</a>	
	<i>Ficus maxima</i>	higuerón	native	tree	WL; F				Frequently growing along streams and more commonly found in the seasonally dry areas, at lower elevations from sea level to around 1,000 metres. Moist or wet forest or fields, often in pastures, by roadsides, or along stream beds	<a href="http://tropical.theferns.info/vi-ewtropical.php?id=Ficus+maxima">http://tropical.theferns.info/vi-ewtropical.php?id=Ficus+maxima</a>	
	<i>Ficus trachelosyce</i>	higuerón	native	shrub	WL; F				rain, savannas, chiquitano	<a href="http://www.efloras.org/florataxon.aspx?flora_id=40&amp;taxon_id=242431721">http://www.efloras.org/florataxon.aspx?flora_id=40&amp;taxon_id=242431721</a>	Synonym to <i>Ficus pertusa</i> (www.efloras.org)
	<i>Trophis racemosa</i>	white ramoon, ojochillo	native	tree	WL; F		Not wetland				In USDA database, <i>Trophis racemosa</i> (L.) Urb

Muntingiaceae	<i>Muntingia calabura</i>	capulín, capulín blanco	native	tree	WL; F				UPL	<a href="http://florida.plantatlas.usf.edu/Plant.aspx?id=1551">http://florida.plantatlas.usf.edu/Plant.aspx?id=1551</a>	
	<i>Piper amalago</i>	alcotán	native	shrub	WL; F		Not wetland				In USDA database, <i>Piper amalago</i> L.
	<i>Piper hispidum</i>	jamaican pepper, candelillo	native	shrub	WL; F		FACW	Caribbean			
	<i>Piper marginatum</i>	marigold pepper, hoja de estrella	native	shrub	WL; F		Not wetland				In USDA database, <i>Piper marginatum</i> Jacq.
	<i>Piper tuberculatum</i>	spanish elder, candelillo	native	shrub	WL; F		OBL	Caribbean			In USDA database, synonym to <i>Piper swartzianum</i> (Miq.) C. DC.
Poaceae	<i>Paspalum fasciculatum</i>	Crowngrass, gamalote	native	grass	WL; D		FACW	Caribbean			In USDA database, <i>Paspalum fasciculatum</i> Willd. ex Flueggé
Rubiaceae	<i>Genipa americana</i>	Jagua, guaitil	native	tree	WL; F		Not wetland				In USDA database, <i>Genipa americana</i> L.
	<i>Palicourea guianensis</i>	showy cappel, cafecillo	native	shrub	WL; A		FACU	Caribbean			In USDA database, <i>Palicourea guianensis</i> Aubl.
	<i>Pentagonia tinajita</i>		native	shrub	WL; A				Characteristic species of well-drained, unflooded lowland forest.	<a href="http://www.inbio.ac.cr/ecomapas/acosaing/ubi_natural1.htm">http://www.inbio.ac.cr/ecomapas/acosaing/ubi_natural1.htm</a>	
	<i>Zanthoxylum acuminatum</i>	lagartillo	native	tree	WL; A		FAC	Atlantic and Gulf Coastal Plain	In Costa Rica it is widely distributed in damp and wet forests, at an elevation of 200-2000 m	<a href="http://www.crbio.cr:8080/neoportal-web/species/Zanthoxylum%20acuminatum">http://www.crbio.cr:8080/neoportal-web/species/Zanthoxylum%20acuminatum</a>	In USDA database, <i>Zanthoxylum americanum</i> Mill.
Scrophulariaceae	<i>Scoparia dulcis</i>	licorice weed, escobilla amarga, mastuerzo	native	herb	WL; A		FAC	Caribbean			In USDA database, <i>Scoparia dulcis</i> L.
Simaroubaceae	<i>Quassia amara</i>	quassia Wood, hombre grande	native	tree	WL; F		Not wetland				In USDA database, <i>Quassia amara</i> L.
Sterculiaceae	<i>Sterculia apetala</i>	panama tree, Panamá	native	tree	WL; F		Not wetland				In USDA database, <i>Sterculia apetala</i> (Jacq.) Karst.
Tiliaceae	<i>Luehea seemannii</i>	guacimo colorado	native	tree	WL; A		Not wetland (species: <i>L. speciosa</i> )		It often grows along water courses because it prefers alluvial soils, although it is found in hills up to 600 meters, with rainfall from 1400 to 4000mm. It is also common in secondary forests. In Costa Rica it is found in humid forests at elevations below 400m and in deciduous forests, mainly on floodplains.	<a href="http://www.arbolesdecentroamerica.info/index.php/en/species/item/download/169_d12fe998efb292b78aa0abddec069439">http://www.arbolesdecentroamerica.info/index.php/en/species/item/download/169_d12fe998efb292b78aa0abddec069439</a>	In USDA database, <i>Luehea speciosa</i> Willd.
Ulmaceae	<i>Trema micrantha</i>	Nettle tree, capulín	native	tree	WL; F		Not wetland				In USDA database, <i>Trema micrantha</i> (L.) Blume

<sup>1</sup> For species that were not listed in the USDA database, and where a similar species was listed in the database, a status for the similar species was included as "Not wetland (species: a)", where "a" = the name of species that was in the database, which is listed in the Notes column.