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Mediterranean Fruit Fly Cooperative Eradication Program

Cabo Rojo Municipality, Commonwealth of Puerto Rico

Environmental Assessment, April 2015

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I. Need for the Proposal

The Mediterranean fruit fly (Medfly), *Ceratitis capitata* (Wiedemann), is a major pest capable of devastating crops throughout many parts of the world. Because of its wide host range (over 260 species of fruits and vegetables) and its potential for rapidly expanding infestation, the Medfly represents a serious threat to U.S. agriculture. Medfly is established elsewhere in the Western Hemisphere. The first U.S. detection of Medfly was in Hawaii in 1907; by 1910 Medfly was established there (UFL, 2010; Mau and Kessing, 2007).

Although Medfly has been periodically introduced to the U.S. mainland since 1929 (APHIS, n.d.), successful eradication programs have prevented it from becoming an established pest in the conterminous United States. Medfly establishment would be disastrous to agricultural production in many regions of the United States where host plants are grown. The unchecked presence of Medfly on the U.S. mainland could result in widespread destruction of crops, such as apple, apricot, avocado, cherry, citrus, fig, nectarine, peach, and peppers. Commercial crops, as well as dooryard production of host fruits, would suffer if Medfly populations became established. Fruit infested by Medfly is unfit to eat because the larvae tunnel through the fleshy part of the fruit, damaging it and subjecting it to decay from bacteria and fungi.

On March 3, 2015 an unmated wild female Medfly was found in a Jackson trap on a *Terminalia catappa* tree, in a residential section of Cabo Rojo, a municipality in the Commonwealth of Puerto Rico (APHIS, 2015a; FDACS, 2015a). The fly is believed to have originated from a Medfly outbreak 86 miles away in the Dominican Republic, likely transported in baggage or in a fruit shipment, or possibly in an undocumented boat crossing the Mona Passage. On March 19, 2015 another wild Medfly adult was collected from a Jackson trap in a citrus tree growing about 0.96 miles (1.55 km) from the March 3 detection site (APHIS, 2015b; FDACS, 2015b). Florida's Department of Agriculture and Consumer Services-Division of Plant Industry is recognized by the U.S. Department of Agriculture as a final authority to make confirmations and analysis of Tephritidae fly species and life stages for Puerto Rico; Florida confirmed both detections as wild Medfly. The second detection was confirmed on March 20 and was sufficient to trigger an APHIS emergency quarantine and eradication response. This is the first U.S. Federal eradication program for exotic fruit fly in Puerto Rico.

Puerto Rico is a potential gateway for the introduction of fruit flies from the Caribbean region into the continental United States. This is due to Puerto Rico's tropical climate, its range of Medfly host plant growth, and

its close association to neighboring islands that also have the potential to support fruit fly populations year-round. Many tourists travel from these islands to Puerto Rico and continue to the continental United States. Major export commodities in Puerto Rico include Medfly-host species of nuts and fruits, vegetables, and coffee—the commonwealth's agricultural production and climate is sufficient to sustain large Medfly populations (APHIS, 2006).

A comprehensive exotic fruit fly trapping program for detection purposes was inaugurated in Puerto Rico in 1979. A pre-clearance program is used to monitor Medfly-host commercial exports destined for the continental United States. The current pre-clearance program for mango (APHIS, 2006) includes the following techniques:

- installation of traps in orchards to monitor *A. suspensa* and *A. oblique* (until the Medfly detection, these were the only two endemic fruit fly species of concern to mainland States)
- cutting of fruit during inspection
- post-harvest treatment with hot water

The Cabo Rojo Medfly detections are located approximately 40 miles from the the nearest international airport (Mercedita International), and about 19 miles from the nearest international seaport in Guánica. In addition to ongoing surveillance, U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) maintains a domestic pre-departure program in Puerto Rico to mitigate the risk of fruit flies being introduced to the U.S. mainland. The pre-departure program screens passenger baggage moving from Puerto Rico to the continental United States (APHIS, 2006). Exotic fruit flies of quarantine significance that can impact Puerto Rico include the following species:

- Caribbean fruit fly (*Anastrepha suspensa*)
- Mediterranean fruit fly (*Ceratitis capitata*)
- oriental fruit fly (*Bactrocera dorsalis*)
- melon fruit fly (*Bactrocera cucurbitae*)
- Mexican fruit fly (*Anastrepha ludens*)
- South American fruit fly (*Anastrepha fraterculus*)
- West Indian fruit fly (*Anastrepha obliqua*)

Although Medfly is not known to be established in Puerto Rico, many host plant species are grown on the island, which increases the potential environmental impact of the Cabo Rojo detections. Medfly-host species grow in almost every community garden and residential property in Cabo Rojo, and grow wild along roads and in undeveloped areas. Small commercial host production (e.g. cucumbers, melons, lemons, and peppers) occuring within 4.5 miles of the Medfly detections is largely

destined for local consumption. The closest plant nursery is about 7 miles away. Organic production of potential hosts occurs outside the current Medfly quarantine boundary (APHIS, 2014c). The map in appendix A shows the location of the confirmed Medfly detections. Because of the species' rapid population growth and potential for damage, Medfly infestations represent a major threat to the agriculture and the environment of Florida, Texas, and other U.S. mainland States.

The government of Puerto Rico and APHIS are working to improve emergency preparedness and response gaps in its system of exotic fruit fly interception and control:

- In 2006, APHIS recommended the development of a cooperative rapid response plan, to boost Puerto Rico's emergency preparedness in the event of an exotic fruit fly detection (APHIS, 2006). Such a plan is needed now to effectively eradicate the current Medfly infestation in Cabo Roja.

- In 2009, the Crop Protection Program (CPP) of the Puerto Rico Department of Agriculture (PRDA) was found to be in violation of Federal pesticide law (EPA, 2009); the CPP agreed to—
  - make improvements to meet worker protection requirements, and
  - ensure that during commercial applications at farms throughout Puerto Rico, less toxic formulations are used, workers receive adequate training, and pesticides are used in a manner consistent with labeling requirements.

APHIS and PRDA are proposing a cooperative program to eradicate the current Medfly infestation and prevent the spread of Medfly to noninfested areas of Puerto Rico and other regions in the United States. APHIS' authority for cooperation in the program is the Plant Protection Act (Title 4 of the Agricultural Risk Protection Act of 2000), which authorizes the Secretary of Agriculture to carry out operations to eradicate insect pests, and to use emergency measures to prevent the dissemination of plant pests new to, or not widely distributed throughout, the United States.

APHIS has cooperated with California, Florida, and Texas State Departments of Agriculture on fruit fly eradication programs since 1984. To date, every targeted fruit fly population on the U.S. mainland has been successfully eradicated. Florida, the nearest geographical mainland State, receives daily connecting flights and shipping from Puerto Rico, and has pursued an ongoing Medfly detection and eradication program since the first introduction of Medfly to that State in 1929. At the time of preparation of this environmental assessment (EA), there is one active

Medfly quarantine in the conterminous United States in Riverside County, California.

This EA considers the environmental consequences of alternatives evaluated for Medfly eradication, and also considers, from a site-specific perspective, environmental issues relevant to this particular fruit fly program. Alternatives for Medfly eradication have been discussed and comprehensively analyzed by APHIS and its cooperating partners.

APHIS first evaluated the environmental impacts of fruit fly control technologies in the "Fruit Fly Cooperative Control Program, Final Environmental Impact Statement—2001" (EIS1) (APHIS, 2001). APHIS reexamined its findings and introduced an additional tool for eradication in "Use of Genetically Engineered Fruit Fly and Pink Bollworm in APHIS Plant Pest Control Programs, Final Environmental Impact Statement—2008" (EIS2) (APHIS, 2008). Each environmental impact statement (EIS) considers fruit fly risks and mitigations at the programmatic level. This site-specific EA incorporates the findings of EIS1 and EIS2 by reference.

The eradication measures being considered for this program have been discussed and analyzed comprehensively within APHIS fruit fly chemical risk assessments (APHIS, 2014a, 2003a, 1999a, 1998a, and 1998b). These documents are also incorporated by reference and summarized within this EA. Environmental documentation for APHIS fruit fly control programs may be viewed online via the following links—
http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/planthealth/sa_domestic_pests_and_diseases/sa_environmental_assessments/ct_plant_health_environmental_assessments/!ut/p/a1/lVHLboMwEPyWHHpEdgjGyZE0KSGPPlJFKVysxZhiBQzCTqr06-vQqlIPedQXe3dndmfHKEFvKFFwkO9gZK2gPMWJz-ZPM7c_xm4UhtMxjh4fls90MXfxilhAfAGwILfx78Ng5tElxtgbujiajGcTOlphHPnX-FuUoIQr05gCxdAUUjNeKyOUYaVMW2iPd1gDq_cty2u-113UlGDrhYDSFF0iqyuhjeSssZdmoDKWSS1Ai2-CUAfZ1qqybaFkoG1enwJb5eZPu_PQk9CGywzFGRAYpQPfoTQljpfmuQOAidPPXU9keU69Pv8xBp85Ab7JmCtf0wEued8BLmiIrUh6dsTUR6__3Hp-da0JSsLPHfkI0Hb6-2yqzaYaDo7Obj3EA7J7CXq9L3Zzwik!/?1dmy&urile=wcm%3apath%3a%2Faphis_content_library%2Fsa_our_focus%2Fsa_plant_health%2Fsa_domestic_pests_and_diseases%2Fsa_environmental_assessments%2Fct_fruitfly for APHIS fruit fly control program environmental documentation, and APHIS GE control applications for plant health.

II. Alternatives

Alternatives considered for the Cabo Rojo Medfly program include (A) no Federal action, (B) quarantine and commodity certification, and (C) the

preferred alternative, eradication using an integrated pest management (IPM) approach. Component techniques of alternative C include the use of chemical pesticides to facilitate the timely elimination of the current Medfly infestation.

A. No Action

Under the no action alternative there would be no Federal efforts to eradicate Medfly or restrict its expansion from the infested area. In the absence of a Federal effort, quarantine and control would be left to the Commonwealth and local government, grower groups, and individuals. Expansion of the infestation would be influenced by any controls exerted over it, by the proximity of host plants, and by climatic conditions.

"No treatment" might be the only reasonable alternative for some sensitive sites. In such cases, lack of treatment could lead to a continuing and expanding infestation. An expansion of the infestation would likely result in substantial economic losses to growers in Puerto Rico and the remainder of the United States, as well as the loss of U.S. export agricultural markets.

Under the no action alternative, APHIS would continue cooperative practices to support PRDA's detection trapping program and research. For information about the Commonwealth of Puerto Rico's program to control Medfly, please contact:

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No Action and Medfly in the Western Hemisphere

Taking no Federal action in Cabo Rojo Municipality is expected to result in additional quarantine and eradication activity should Medfly infestations spread over Puerto Rico and to the U.S. mainland. Wild Medfly was first reported on the mainland in Florida in 1929, infested an area of Texas in 1966, and has been detected almost annually in California in recent years; each infestation has required intensive eradication procedures to prevent establishment in the continental United States.

Puerto Rico is connected by trade to many nations in the Western Hemisphere that also trade with the U.S. mainland. The following

Western Hemisphere countries are currently reported to have established unmanaged Medfly populations, and also ship agricultural exports to the United States (Nelson, 2014; APHIS, 1999b; CABI, 2014)—

- **Central American and Caribbean Regions:** Costa Rica, Nicaragua, Panama, Honduras, El Salvador. Data for Jamaica and the Netherlands Antilles is either absent or unreliable.

- **South America:** Bolivia, Brazil, Colombia, Paraguay, Peru, Uruguay, Venezuela, Argentina

B. Quarantine and Commodity Certification

This alternative combines a Federal quarantine with commodity treatment and certification, as stipulated under Title 7 of the Code of Federal Regulations (CFR) § 301.32. Regulated commodities harvested within the quarantine area would not be allowed to move unless treated with prescribed applications, and certified for movement outside the area. For a large infestation, intensive quarantine enforcement activities could be necessary, including safeguarding of local fruit stands, mandatory baggage inspection at international airports and seaports, and judicious use of road patrols and roadblocks. The quarantine actions of this alternative would result in a reduction of Medfly escape from treated crops to unifested areas, and a reduction of human-mediated movement of Medfly in host plant materials to areas outside the quarantined area. However, the infestation could remain established within the quarantine boundary. Any Medfly eradication efforts would be managed by, and wholly under the control of, PRDA.

Inter-municipality movement of regulated commodities in Puerto Rico would require the issuance of a certificate, or limited permit, contingent upon commodity treatment or the grower or shipper complying with specific conditions designed to minimize pest risk and prevent the spread of Medfly. Eradication methods that may be used in this alternative include (1) regulatory chemicals, (2) cold treatment, (3) vapor heat treatment, and (4) irradiation treatment. All regulatory chemical treatments must be registered and labeled for use in Puerto Rico and may include fumigation with methyl bromide in enclosed areas or containers, and ground-based spray applications of a mixture of protein hydrolysate bait with either spinosad or malathion. Protein hydrolysate bait is an attractant and food source mixed with an pesticide for treating Medfly infestations (APHIS, 2003b). (Refer to EIS1 (APHIS, 2001) for more detailed information about these chemicals and their uses.) Cold treatment, vapor heat treatment, or irradiation treatment of host material and certain produce, as a requirement for certification and shipping, must be conducted in facilities approved by APHIS.

C. Eradication Using an IPM Approach (Preferred Alternative)

APHIS' preferred alternative for the Cabo Rojo Medfly program is eradication using an integrated pest management (IPM) approach. This alternative combines quarantine and commodity certification with eradication treatments. Successful eradication of Medfly by APHIS and the State of Florida, using a similar IPM strategy, was declared in July 2011, thus the quarantine was removed (FDACS, 2011). Monitoring for Medfly is continuous in the United States throughout Florida, Texas, and California.

For many species of exotic fruit flies, effective nonchemical control or eradication techniques do not exist (APHIS, 2001). APHIS has determined there are no non-pesticidal options available to effectively eradicate Medfly (APHIS, 2003b; FDACS and APHIS, 2011). Eradication efforts may employ any or a combination of the following:

- no action
- detection trapping
- eradication chemical applications
- sterile insect technique (SIT)
- host removal
- regulatory quarantine treatment and movement control of host materials

APHIS' cooperative programs to eradicate Medfly in the conterminous United States have well-established procedures and treatments that are expected to be equally effective in Puerto Rico. The Cabo Rojo program for Medfly eradication will be conducted by APHIS- and PRDA personnel on quarantined properties, using chemical formulations and non-aerial, ground-based treatment protocols approved by APHIS and Puerto Rico Department of Agriculture (PRDA) (APHIS, 2003b). All program chemical formulations must be registered and labeled for use in Puerto Rico. (To view the program area[1] proposed for eradication treatment applications and regulatory quarantine action, see the map in appendix A.) Figure 1 illustrates one example of a PRDA employee in protective gear making a ground-based targeted foliar spray application.

The current program area lies within Cabo Rojo Municipality. Under the preferred alternative, delimitation, targeted pesticide treatments, and monitoring are carried out for approximately 81-square miles around each

[1] For the purposes of this document, and unless specified otherwise in the text, the terms "quarantine" and "program area" signify the same location. "Eradication zones" or "core areas" are always found inside the program area, and are the only locations where eradication activities may be carried out.

property on which an adult fly has been trapped, or on which another life stage of Medfly is detected. A form of biological control (sterile insect technique, (SIT)) is used in conjunction with targeted chemical control using spinosad or malathion bait spray around the detection sites. Fruit sampling is also employed around each detection property; fruit removal occurs where there is evidence of a breeding population (APHIS, 2003b).

Several types of traps—such as McPhail, Jackson, ChamP, and Multilure—may be used to delimit the infestation, and to determine the efficacy of treatments. All monitoring traps will be serviced for a period equal to three Medfly life cycles beyond the date of the last fly detection. The treatment plan for Medfly within the Cabo Rojo eradication zone will include targeted, ground-based applications of an organic formulation of spinosad or malathion and protein bait to the foliage of all host trees and plants within a 200-meter radius of each detection site. These are foliar applications and may be applied with hydraulic spray or hand-spray equipment. This treatment will occur at 7 to 10 days for one life cycle beyond the last Medfly detected (APHIS, 2003b).

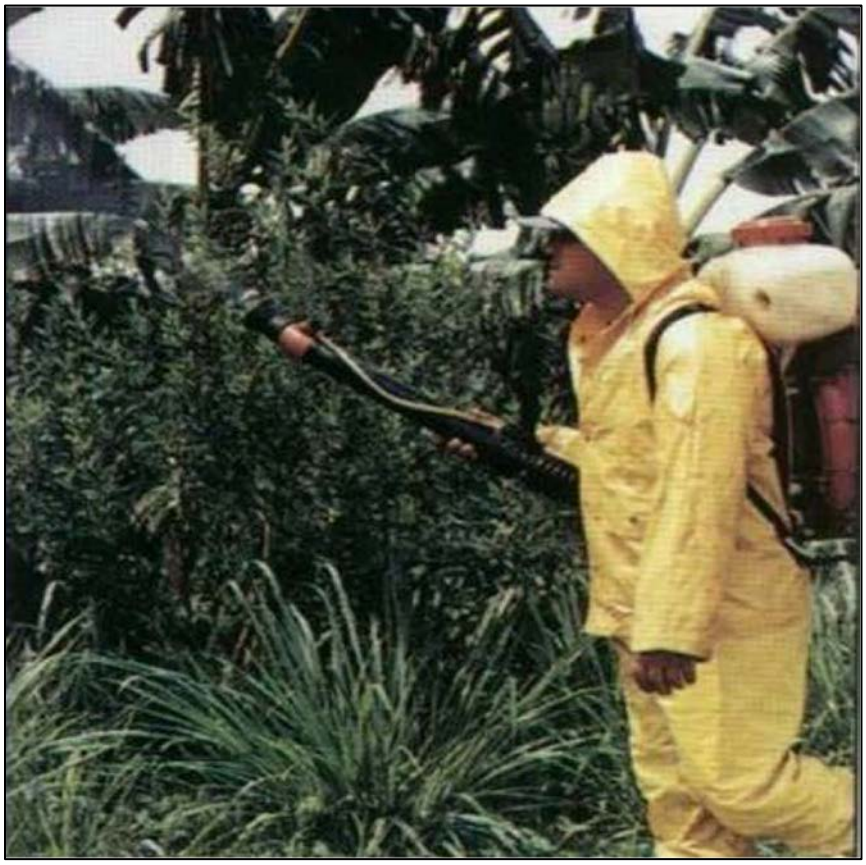

Figure 1. PRDA employee applying a targeted chemical spray.
(Source: PRDA, n.d.)

The program area will receive a periodic release of sterilized male Medflies in order to disrupt the reproduction cycle and control the wild population. Releases will be repeated twice a week to achieve a weekly release rate of 250,000 sterile Medflies per square mile, and will continue for two life cycles beyond the last Medfly detection date. Larval surveys are conducted 200 meters around any property where a Medfly is trapped. Where Medfly larvae or pupae are discovered, fruit from the infested property, and up to 200 meters around the find site, is removed and taken for disposal under regulatory compliance (APHIS, 2003b).

Adult Medflies can be carried a mile by the wind (UFL, 2010) and even farther via airplane, ship, or land vehicles, making it possible for host-plant growing areas outside an eradication zone to become infested. Regulatory treatments used for movement of commercial produce are included in the event that the eradication zone should expand to include commercial groves or orchards or fields of potential host crops. Growers will be able to move their harvested fruit out of the quarantined area, under a limited permit, to enclosed facilities for processing into juice, or after APHIS-approved methyl bromide treatment in the field or at the packing shed. Should the Medfly quarantine spread to federally protected historical property, sensitive habitat, or wilderness, program treatments will be restricted to those approved for the type of site in question.

Before taking action, program officials are to inform the public and impacted industry via press releases, meetings, and other forms of communication appropriate for the recipients. Notification letters will be sent to trading partners as they are identified. Given the potential impacts to commercial production, grove owners, packing sheds, nurseries, vendors, and other industry operations handling Medfly host material will be notified of the Medfly quarantine location and treatment schedule. Treatments will be repeated daily for 7 to 14 days (or one Medfly life cycle). The eradication project will continue for three life cycles past the date of the last Medfly trapped (APHIS, 2003b). (For more detailed information on the alternatives considered for Medfly control and their component methods, refer to the previously mentioned fruit fly risk assessments (APHIS, 2014a, 2003a, 1999a, 1998a, and 1998b)).

III. Potential Environmental Consequences

This chapter of the EA analyzes the potential environmental consequences of alternatives considered for Medfly control, and considers, from a site-specific perspective, the program's potential to affect human health, nontarget species (including threatened and endangered species), and environmental quality. The proposed program area and its environmentss are described. Potentially sensitive areas are identified, considered, and accommodated through special selection of control methods and use of specific mitigation measures. Should Medfly detections lead to an expansion of the program area, APHIS will conduct any necessary additional environmental analysis.

A. No Action

Lack of Federal action would place the entire burden of eradication on the Commonwealth of Puerto Rico. It is reasonable to expect that Medfly populations would continue to expand in area, leading to increased quarantine efforts. Any failure of those efforts could lead to the establishment of this pest within Puerto Rico, and lead to introduction on the U.S. mainland. If eradication attempts are unsuccessful, APHIS expects substantial economic losses to growers in Puerto Rico. Crop loss is likely to lead to commodity scarcity, higher costs for local consumers, and the temporary or permanent loss of Puerto Rico's export markets.

B. Quarantine and Commodity Certification

The quarantine actions of this alternative would result in a reduction of the human-mediated movement of Medfly in host plant materials outside the quarantine boundary. A resident population is likely to remain established within the quarantine boundaries. Any failure in quarantine actions could lead to Medfly establishment outside the program area. The commodity certification requirement would create a necessary, but new layer, of governmental presence in the marketplace. This situation would create inspection jobs, but restrict trade until the produce was inspected and certified for sale. Growers could lose export markets. Host plant species would likely cease being grown for domestic use as landowners shifted to non-Medfly host plants. Uncontrolled Medfly populations coupled with the unrestricted movement of infested host materials could lead to the extinction of certain at-risk plant species, and disruption of the natural ecology in affected areas.

C. Eradication Using an IPM Approach (Preferred Alternative)

The preferred alternative, eradication using an integrated pest management (IPM) approach, may employ any or a combination of the following measures:

- no action
- quarantine
- detection trapping
- regulatory chemical application (fumigation, bait spray)
- eradication chemical applications (bait spray)
- cold treatment
- vapor heat treatment
- irradiation treatment
- sterile insect technique (SIT)

APHIS' cooperative eradication programs are designed not only to respond to pest infestations, but also to minimize future outbreaks by reducing the pest population. For many years, the use of sterile insect release (SIT) in the Mediterranean Fruit Fly Preventive Release Program on the U.S. mainland has supported this dual objective; the program is a year-round cooperative effort between APHIS and State partners. Sterile fly release programs continue to successfully reduce the populations of Mediterranean fruit fly and Mexican fruit fly in North America; both species are dangerous to agricultural produce and can severely impact saleable fresh produce. (Both species are considered substantial threats to U.S. agriculture, as well as to the agriculture of their host countries.) Using SIT to suppress Medfly in Puerto Rico is expected to stabilize foreign trade in agricultural products, and greatly reduce the threat of introducing these pests into the U.S. Virgin Islands as well as to other parts of the United States (APHIS, 2014b).

1. Affected Environment

Orchards and groves, hydroponic and traditional farms, plant nurseries, natural and conservation lands, recreational and residential landscaping, wholesale produce markets and fruit stands occurring in areas where Medflies are detected may be affected by the cooperative eradication program. In Cabo Rojo, there is commercial host production for local consumption within the program area.

a. Land Characteristics and Demographics

At present, the Medfly program area covers about 30 square miles of land in Cabo Rojo Municipality on the southwest corner of Puerto Rico, the main island of the Commonwealth. The area in and surrounding the infestation is a mixture of rural and residential districts, tourist attractions,

highways and waterways, conservation areas and undeveloped seacoasts with popular swimming beaches. Puerto Rico's western region is similar to the Southwest on the U.S. mainland—cacti and rock formations, rangeland suitable for cattle, and hills and valleys with forests. The peninsula of Cabo Rojo has been compared to Baja California (Frommers, 2015). Besides being a popular holiday destination for locals and eco-tourists, the coastline of Cabo Rojo is also one of the places where immigrants and smugglers attempt to enter from neighboring countries, including Cuba, the Dominican Republic, Ecuador, and Haiti (CBP, 2012; DominicanToday, 2011). (Figure 2 maps the area between Puerto Rico, neighboring islands, and the U.S. mainland.)

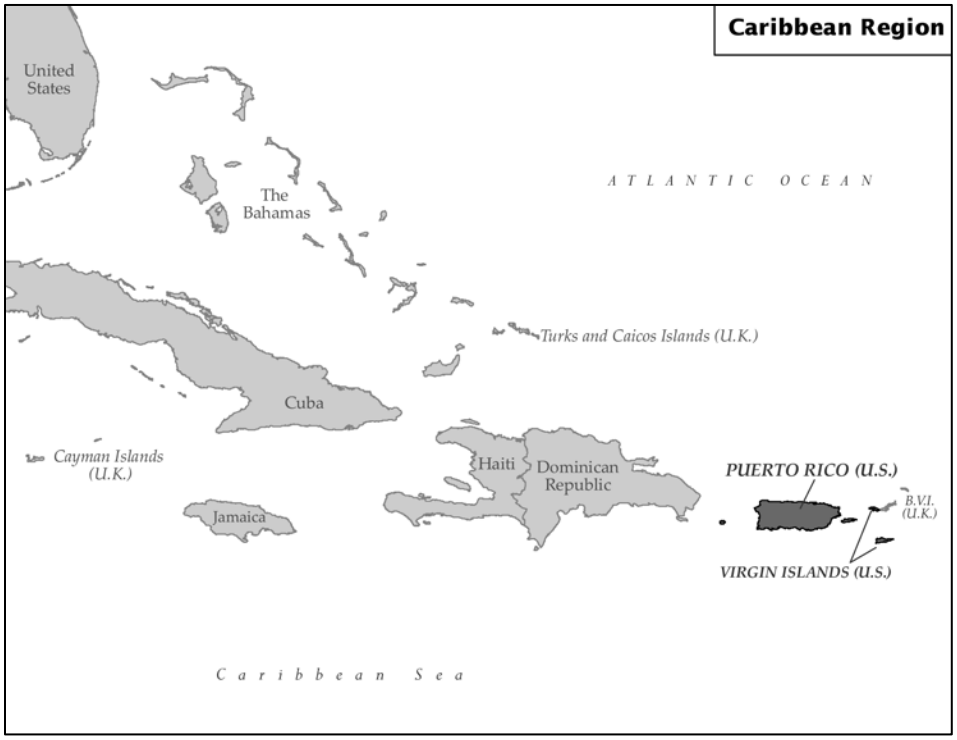

Figure 2. Island territories of the United States: Caribbean region. (Source: USCB, 2012)

The island of Puerto Rico is located 994 miles southeast of Florida, directly east of the Dominican Republic, and west of the Virgin Islands, with the Caribbean surrounding its southern and western coasts and the North Atlantic Ocean bordering the northern and eastern coasts. The Caribbean tends to be less salty than the Atlantic, with warm counterclockwise currents that flow from the Lesser Antilles islands through the Yucatan Channel. The west coast of Puerto Rico bordering the Caribbean is known for its abundance of beaches. Comparatively speaking, the island is about three times the size of Rhode Island. The Commonwealth consists of the main island of Puerto Rico (maximum distance across is 112 miles long, 40 miles wide), and the smaller islands

of Culebra, La Mona, and Vieques. Puerto Rico has a surface area of 3,507 square miles. Elevation ranges from sea level to 4,400 feet above sea level.

Recreational parks and large portions of the Cabo Rojo National Wildlife Refuge are within or near the Medfly program area (see figure 3). Laguna Cartagena National Wildlife Refuge is approximately 5.5 miles away. Pollution and other human activity is a major cause of coral reef degradation in Puerto Rico. Primary pollutants in a 2012 study were municipal wastewater and sewage discharges, urban and agricultural runoff, and recreational and commercial boating (EPA, 2015).

Figure 3. Wildlife conservation in the vicinity of the Medfly program area. (Source: See appendix C for refuge data sources.)

Based on U.S. Census estimates, the resident population of Cabo Rojo Municipality in 2013–14 was 50,846 compared to 3,548,397 for the entire Commonwealth (USCB, n.d.). Large numbers of seasonal visitors, primarily during spring and summer, cause Cabo Rojo's population to fluctuate. Puerto Rico is a self-governing territory divided into 8 senatorial districts, 40 representative districts, and 78 municipios (municipalities, including Cabo Rojo). The chief of state is the President of the United States of America; the head of the Puerto Rican government is the Governor. Puerto Rican civil and commercial codes are fashioned

after Spanish models; penal, procedural, and public (including constitutional) law are fashioned after U.S. models. The central government functions in many ways as State governments do; it also assumes responsibility for local police and fire protection, education, public health and welfare programs, and economic development. The official languages of the commonwealth are Spanish and English (GDB, 2015; Ramon, n.d.; Rivera, 2015).

Until 1955, agriculture constituted Puerto Rico's main economic sector. Sugar cane, mostly for export to the U.S. market, was the main crop, followed by coffee and tobacco. Today, agriculture accounts for only 3 percent of the labor force and less than 1 percent of the gross domestic product, and is concentrated primarily on crops which can be sold in the United States. (See appendix B for a map showing principal areas of agricultural production in Puerto Rico.) Coffee is the most valuable crop, followed by vegetables, sugar cane, fruits (pineapples, plantains, bananas), milk, eggs, and livestock (cattle, chickens, pork). Exports totaled $69.75 billion in a 2013 estimate; in 2010, major export commodities included chemicals, electronics, rum, beverage concentrates, and medical equipment, among others. The United States is Puerto Rico's primary trading partner and receives over 90 percent of the commonwealth's exports. Puerto Rico exports to other countries (Rivera, 2015) such as the United Kingdom, the Netherlands, and the Dominican Republic.

Data collected by the U.S. Census Bureau shows that in 2010, out of a total 950,570 Puerto Ricans employed, 1,340 worked in farming, fishing, and forestry sectors. Seventeen workers of every thousand were employed in agriculture. The overall unemployment rate in Puerto Rico was 16 percent in 2010. Gross product and net income for agriculture were $63,292 million and $49,547 million, respectively. Exports to the United States totaled $47,630 million; exports to other countries totaled $20,707 million. The amount of land used for farming decreased between 2002 and 2007—from 690,687 cuerdas to 557,530 cuerdas. (A "cuerda" is slightly less than 1 acre.) Medfly-host crops in 2007 were valued around $505,000,000. About 4,900 tourists per 1,000 residents visited the Commonwealth that year, spending an average of $738 per visitor (USCB, 2012).

Puerto Rico's capital, Municipio de San Juan Bautista (San Juan), is approximately 3.5 hours airtime from New York City, and 4 days' sailing from Atlantic ports in the mainland United States (GDB, 2015). The Commonwealth has faced severe damage and loss of life in the past century from tsunamis. The Puerto Rico Trench, which creates the boundary between the Atlantic Ocean and the Caribbean, is the deepest part of the Atlantic Ocean, more than 27,000 feet below the ocean's surface. As the boundary separating two shifting tectonic plates, it lies

directly below the main island and has been the source of multiple earthquakes that have measured over 7.0 on the Richter magnitude scale. Trade winds blow consistently from east-northeast or east in the winter and from east-southeast in the summer. Stronger wind speeds are recorded during summer and winter than in spring and autumn (Ramon, n.d.; Morelock et al., 2001).

The Commonwealth of Puerto Rico occupies part of a volcanic island platform (shelf) that also includes the British and U.S. Virgin Islands. The platform can be described in terms of the north, east, south, and west provinces. The north is the narrowest and is marked by higher wave energy, and more terrigenous sediments (that is to say, sediments derived from the erosion of rocks on land, or other terrestrial sources). The east, south, and west provinces contain coral reefs and predominantly carbonate sediments. Marine habitats on the island platform have been diminished by excessive influxes of sediments and nutrients, and by overfishing. During the past 50 years, more than 50 percent of the living coral has been lost and the rate of loss of reef areas has accelerated during the past 20 years. The high population density (>1,000 people per square mile) and a shift of population to coastal areas is believed to have indirectly intensified these losses (Ramon, n.d.; Morelock et al., 2001).

Puerto Rico maintains a mean year-round temperature of 80˚F. Tropical plants are in abundance. The host plant where the March 3rd Medfly was trapped is commonly known as the tropical almond or beach almond; its seeds are dispersed by water.

b. Water Resources

Puerto Rico is bounded by the Atlantic Ocean and the Caribbean Sea, but its waters are salty and unsuitable for drinking or irrigation. Two watersheds occur within the municipality of Cabo Rojo including the Culebrinas-Guanajibo Watershed to the north and the Southern Puerto Rico Watershed to the south. The U.S. Environmental Protection Agency (EPA) lists fecal coliform as the primary water pollutant in Puerto Rico; pesticides were the fourth highest source of impairment to lakes, rivers and ponds in 2012, and the tenth highest to rivers and streams (EPA, 2015). (See table 1 for data on water quality in Puerto Rico.)

Summer rainfall deficits created abnormally dry to moderate drought conditions in the Commonwealth of Puerto Rico in 2014. June and July were drier than normal across most of Puerto Rico, with the exception of the western interior. In Puerto Rico, rainfall deficits have led to regional droughts every 15 to 18 years, on average. Drought has the potential to affect public water supply for the residents of Puerto Rico because reservoirs are the principal source of fresh water. The reservoir water

Table 1. 2012 Water Quality Assessment for Puerto Rico.

Designated Use and Locations	Amount Assessed	Percent Impaired
Aquatic life, lake/reservoir/pond	8,102.6 acres	100.0
Drinking water supply, lake/reservoir/pond	4,769.6 acres	77.2
Aquatic life, rivers/streams	4,912.7 miles	81.1
Drinking water supply, rivers/streams	4,739.0 miles	77.6
Aquatic life, bays/estuaries	5.3 sq. miles	95.0
Drinking water supply, bays/estuaries	.1 square mile	100.0
Aquatic life, coastal shoreline	291.5 miles	87.0
Drinking water supply, coastal shoreline	N/A	N/A

(Source: EPA, 2015)

levels are dependent on rainfall and stream flow. The total amount of available storage volume in reservoirs also limits water supply; sedimentation has reduced storage volume in several reservoirs. Determining the sustainable water yield of reservoirs is a difficult challenge under prolonged below-normal rainfall, and climate change amplifies this challenge. During the hurricane season, hydrologic conditions can change rapidly in response to tropical systems. In August 2014, Tropical Storm Bertha crossed the southern part of Puerto Rico. This storm provided sufficient rainfall to restore or partially restore water levels in some reservoirs (USGS, 2015). (See figure 4 for information on how Puerto Rico allocates its surface water and ground-water resources.)

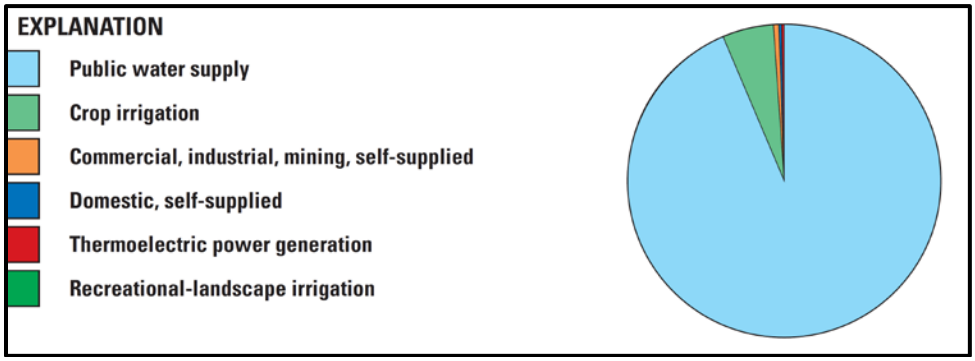

Figure 4. 2010 Water Use in Puerto Rico.
(Source USGS, 2015)

Water Resources Within or Near the Medfly Program Area

The Medfly program area is located within the "Southern Puerto Rico" watershed designated 21010004, which measures about 533,790 acres. The distance from the Medfly infestation to the nearest coastal water is approximately 0.5 mile. The Cabo Rojo Urbano public water system consists of six wells (Hacienda la Margarita, Cabo Rojo Pozo I, Cabo Rojo Pozo II, Cabo Rojo Pozo III, Club de Leones, and Ana Maria) serving approximately 48,453 people. The Ana Maria Well acts as an independent system that serves approximately 1,856 persons, while the Club de Leones Well is interconnected with the remaining wells. The Ana Maria Well and the Club de Leones Well are 9.2 miles and 9.5 miles, respectively, from the Medfly detections (see appendix C for water resource data sources).

Cabo Rojo Municipality is a popular domestic and international tourist destination. This has resulted in increased water consumption and a consequent need to find and develop additional sources of potable water. The U.S. Geological Survey, in cooperation with the Puerto Rico Aqueduct and Sewer Authority, conducted an investigation to define the occurrence and movement of ground water in the area, and to determine the hydraulic properties on the Bajuras limestone aquifer near Cabo Rojo. This aquifer is the main source of potable water for the municipality. The possibility of a hydraulic connection between the Bajuras limestone aquifer and an associated freshwater wetland, the Ciénaga de Cuevas, was investigated as part of this study. It was found that Ciénaga de Cuevas partially recharges the Bajuras limestone aquifer in response to the ground-water withdrawals from the aquifer. Furthermore, analysis of the data collected indicates that ground-water reserves in the Bajuras/Ciénaga de Cuevas limestone aquifer system may be sufficient to partially or fully satisfy the future water-supply needs of the Cabo Rojo area. The municipality of Cabo Rojo, therefore, decided to include in its development plan the Bajuras/Ciénaga de Cuevas area as a region to be preserved in its present state (USGS, 1995).

Quarterly ground water samples collected by Puerto Rico Aqueduct and Sewer Authority from 2002 to 2006 indicated the presence of tetrachloroethene (PCE) and trichloroethene (TCE) in public supply wells within the Cabo Rojo Urbano System, in particular the Ana Maria Well. Ground water samples collected by EPA in July 2006 and September 2009 confirmed the presence of PCE and TCE in the Ana Maria Well. Although EPA did not positively identify the source of ground water contamination in the public supply wells, chlorinated solvents were detected at two drycleaners and one printshop (see appendix C for ground-water data sources).

The Cabo Rojo Ground Water Contamination Site is located 8.73 miles from the nearest Cabo Rojo Medfly detection. The Agency for Toxic Substances and Disease Registry assessed the site and reported that current exposures to volatile organic compounds (VOCs) in municipal water are not expected to harm public health. Although low levels of VOCs have been found in some municipal water supply wells, they remained within Federal drinking water standards (see appendix C for ground water data sources).

The following are impaired water bodies (not used for drinking supply) within 15 miles of the Medfly detection. These are also the major bodies of water in the program area—

- Río Loco—2.2 miles from Medfly detection
- Quebrada Boquerón—3.77 miles from Medfly detection
- Río Guanajibo—11.58 miles from Medfly detection

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Table 2 shows local water discharge facilities with an NPDES permit and their distance from the Cabo Rojo Medfly infestation.

The Medfly eradication program calls for highly localized chemical applications on designated properties and no-spray buffers around all sensitive areas, including all bodies of water. This method of application is designed to minimize the potential for introduction of program chemicals to Cabo Rojo water resources.

2. Human Health

The principal concerns for human health are related to potential program use of chemical pesticides, including spinosad or malathion bait applications and methyl bromide (a fumigant). Factors that influence the human health risk associated with pesticide use include pesticide toxicity and exposure to humans which is influenced by the use pattern and environmental fate for a particular pesticide. The chemical attractants and pesticide in program traps used for detecting Medfly presence are not causes for human exposure concern when the traps are deployed and collected according to label instructions.

Spinosad is toxic to specific invertebrate species but has low toxicity to humans and other mammals (APHIS, 2014a and 1998a). Limited data exists regarding the toxicity of the protein hydrolysate bait used in the spinosad formulation, however, available data suggests low acute toxicity to human health.

Table 2. NPDES Facilities Within 15 Miles of the Cabo Rojo Medfly Infestation.

NPDES Facility	Distance in Miles
Prasa Boquerón	3.38
Recreational Development Co.	3.59
Haciendas De La Baume	5.17
Municipality Of Lajas Landfill	5.55
Vista Verde Development	6.87
Agricultural Experiment Substation Upr	7.65
Galería 100 Estates Corp.	8.39
Cabo Rojo	8.49
Mirador Del Sol	8.60
Boquerón Country Club	8.60
Lajas	10.15
Prasa Wtp Lajas Filter Plant	10.65
Betteroads Asphalt Plt Cabo Rojo	11.02
Portal De San Germán Construction Site	11.56
San Germán	12.25
Municipality Of Hormigueros	12.30
Prasa Wtp San Germán Filter Plant	12.72
San German Wastewater Treatment Plant	12.97
Widening Pr-122 (San German)	13.17
San Germán Surf And Water Park Construction Site	13.37
Cemex Concretos - San German 11	13.52
Cemex Concretos, Inc., Planta San German 1	13.99
Moder. Ext. Sabalos Gardens	14.64
Moder. Ext. Sabalos Gardens	14.64

(Source: NEPAssist —see appendix C for data source)

Malathion is an organophosphate pesticide that targets the nervous system and acts by inhibiting acetylcholinesterase. In humans and other mammals, malathion is metabolized to its oxon (malaoxon), a more potent cholinesterase inhibitor than malathion. Certain enzymes and other metabolic processes detoxify malathion and malaoxon to water-soluble compounds that are excreted. Mammals are less sensitive to the effects of malathion than insects due to increased metabolic activity resulting in less accumulation of malaoxon (EPA, 2006). Malathion has low acute toxicity via oral, dermal, and inhalation exposure routes. EPA classifies malathion as having "suggestive evidence of carcinogenicity but not sufficient to assess human carcinogenic potential" (EPA, 2006). This indicates that the carcinogenic potential of malathion is so low that it cannot be quantified based upon the weight of evidence. At high doses, human health effects from malathion may include headache, nausea, vomiting, abdominal cramps, diarrhea, blurred vision, muscle weakness and twitching (ATSDR, 2003). However, high dose exposures are not expected from program applications of malathion. Malathion may have synergistic effects when used with other organophosphate or carbamate pesticides (US FS, 2008). However, other organophosphate or carbamate pesticides are not proposed to be used in the Medfly eradication program.

Humans with potential exposure to program pesticides include workers who mix, load, and apply pesticides, and the general public who live in or visit the Medfly eradication program area. Human exposure to these pesticides can vary, depending upon the pesticide and the use pattern. The program use of spinosad or malathion bait is limited to ground-based applications directly to host plants with hand-held, truck mounted or backpack spray equipment. Residential neighborhoods and other areas of public traffic within the Medfly eradication program receive only targeted foliar applications. If spinosad or malathion bait applications are restricted to target surfaces and made in accordance with EPA label instructions, effects to human health are expected to be negligible. This is because the targeted method of ground-based, foliar application greatly lowers the probability of exposure and risk to program workers and the general public. The use of protein hydrolysate as an attractant in the Medfly eradication program will also result in a low risk to human health because of its low toxicity and the targeted application method, resulting in a low probability of exposure and risk to workers and the general public.

During pesticide applications, personal protective equipment or application requirements on the pesticide labels mitigate potential worker exposure and risk. Exposure pathways identified for the general public include the potential for direct contact to pesticides during and after application, and the potential for eating fruits sprayed with pesticides. Program practices (e.g., requirements for public notification and stripping

fruit from all host trees in the known infested property and adjacent properties (APHIS, 2003b)) can further minimize potential human exposure to Medfly program chemicals. Information concerning the Medfly eradication project will consist of press releases and media announcements to the general public. Either the local agricultural commissioner or a public information officer will serve as the primary contact to the media. Any resident with property to be treated will be notified in writing at least 24 hours prior to treatment. Following the treatment, notices will be left with owners detailing precautions to take and safe intervals of time that should elapse before harvesting fruit on their property. Removal of fruit from all host trees in the known-infested property and adjacent properties will mitigate potential exposure via handling and consumption.

The potential for exposure to the general public after pesticide application is low because these chemical pesticides are not persistent in the environment with a half-life of 2.0 to 11.7 days on plant surfaces (spinosad), and 1 to nearly 9 days on foliage (malathion), respectively (Kollman, 2003; NPIC, 2009). (An additional summary of the environmental fate of program pesticides is discussed in the Environmental Quality section of this EA.) Other potential general public exposures can be mitigated through program practices.

Should treatment by methyl bromide fumigation be needed, adherence to EPA label restrictions and application in enclosed areas or containers will protect applicators and the general public from risk of exposure (APHIS, 2007 and 2002).

The analyses and data in EIS1 and EIS2 (APHIS, 2008 and 2001) and associated human health risk assessments (APHIS, 2014a, 1999a and 1998a) indicate exposures to program pesticides, if used in accordance with label instructions, are not likely to result in substantial adverse human health effects. The exposure scenarios for the Cabo Rojo program are not expected to differ substantially from previous Medfly cooperative eradication programs.

APHIS recognizes that a portion of the population may have unusual sensitivity to certain chemicals, and that program treatments may pose a greater danger for these individuals. Special communication strategies have been developed that will mitigate this risk (discussed in detail in appendix C of EIS1 (APHIS, 2001)).

In general, a well-coordinated eradication program using IPM technologies results in the least usage of chemical pesticides, and minimizes their potential to adversely affect human health. The no action alternative or the quarantine and commodity certification alternative is not

expected to eliminate Medfly as readily or as effectively as the eradication alternative. Without an IPM program, there would likely be increased use of pesticides by homeowners and commercial growers, with correspondingly greater potential for adverse impacts to human health.

3. Other Aspects of the Human Environment

APHIS considered the potential environmental impacts of implementing the action alternatives on minority and/or low-income communities, tribal interactions, and historical and culturally sensitive sites in the program area.

A lack of Federal action could result in adverse economic and health impacts on affected producers and consumers, such as decreased harvests, higher consumer prices, loss of local employment, reduced nutritional options, loss of market share, compromised mental and physical health, loss of property, and so on. These indirect impacts are expected to occur to a lesser extent under the quarantine and commodity certification alternative. Substantial adverse effects are not anticipated as a result of carrying out the preferred alternative's surveillance activities, trapping, or program chemical applications. Some local produce could be lost due to fruit stripping of residential and commercial host plants.

At this time, implementation of the preferred alternative is not expected to have adverse impacts on historic or culturally sensitive sites that APHIS has identified within the Cabo Rojo Municipality because APHIS intends to restrict program treatments and activities to an as-needed basis in order to protect these sites. The proposed action is not anticipated to disturb the ground. If APHIS discovers any archaeological resources, the appropriate individuals will be notified.

a. Registered Historic Sites

The National Historic Preservation Act of 1966, as amended (6 U.S. Code (U.S.C.) § 470 et seq.) requires Federal agencies to consider the impact on properties included in, or eligible for inclusion in, the National Register of Historic Places (36 CFR § 63). APHIS is initiating consultation with the State Historic Preservation Office (SHPO) for Puerto Rico based on Medfly interceptions in the Cabo Rojo Municipality.

There are more than 300 registered historic sites in Puerto Rico (NPS, n.d.), and two (Faro de los Morrillos de Cabo Rojo and Las Salinas) are located within the current quarantine area. Nine other historic sites are located within 15 miles of the core of the initial program area. The majority of historic sites appear to be buildings with associated landscaping; however, Punta Ostiones, located 8 miles from the core of the initial program area, and Las Salinas are archeological sites (NEPAssist—see appendix C for data source). To ensure historic

properties will not be adversely affected by the proposed action, APHIS will not conduct aerial chemical applications at locations with historical or archeological importance. Instead, surveillance trapping and fruit stripping by hand may occur. Targeted spraying with a handheld or backpack sprayer may be permitted after consultation with the SHPO. If needed, modifications of normal program activities would be designed to reduce pesticide release at these locations.

b. Native American Considerations

The Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa–mm) secures the protection of archaeological resources and sites on public and Indian lands. Using the Native American Graves Protection and Repatriation Act Online Databases (NPS, 2013; 25 U.S.C. § 3001 et seq.), APHIS determined that there are no federally recognized tribes or tribal lands in Puerto Rico.

c. Environmental Justice

Federal agencies are required to identify and address disproportionately high and adverse human health or environmental effects of their proposed activities as described in Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" and Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks." There is one school within the 4.5 mile radius of the quarantine zone but outside the 200-meter eradication treatment zone—Escuela Sebastian Pabon Alves (NEPAssist – see appendix C for data source). If treatments are needed at this location, APHIS would meet the following program requirements:

- Maintenance of traps and any pesticide applications would occur when children are not present in the immediate area.
- The surrounding landscape plants may have fruit removed by hand-picking.
- If any pesticide applications are deemed essential, then a handheld or backpack sprayer would be used. Any exposure of children to applied products is expected to be negligible based on the Medfly program's application methods and the product formulations.

Using 2010 Census data, 99 percent of the population is Hispanic within 15 miles of the core initial program area. In addition, 96.2 percent of the population speaks Spanish, with 85 percent of the population speaking English less than "very well" (USCB, 2010). To meet the needs of these individuals, advance notice of program activities and potential exposure hazards will be provided in Spanish to residents, and posted in public venues (e.g., bus stations, airports, and at the docks for transient

individuals). In addition, APHIS is translating this EA into Spanish, and will ensure that it is easily accessible by residents in the Cabo Rojo Municipality. If APHIS requires additional personnel to assist with this fruit fly eradication program, it will seek job candidates from within the local population.

4. Nontarget Species

The principal concerns for nontarget species, including threatened and endangered species, relate to the program use of pesticides. Paralleling human health risk, the risk to nontarget species is related to the pesticides' exposure to nontarget species, toxicity to the nontarget species, and fate in the environment. All of the Medfly Cooperative Eradication Program pesticides are highly toxic to invertebrates; however, the likelihood of exposure (and thus, impacts) varies a great deal with the use pattern. In general, a well-coordinated Medfly eradication program using IPM technologies would result in the least use of chemical pesticides, overall, with minimal adverse impacts to nontarget species. The no action alternative is potentially less effective at eliminating Medfly, and would be expected to result in broader and more widespread use of pesticides by homeowners and commercial growers, with correspondingly greater potential for adverse impacts. (Refer to EIS1 (APHIS, 2001) and the associated risk assessments (APHIS, 2014a, 2003b and 1998b) for more information on risks to all classes of nontarget species.)

Current eradication activities in Cabo Rojo will be limited to ground-based foliar applications of malathion or spinosad bait to host plants and the use of SIT to control invasive Medfly populations. The malathion and spinosad treatments target Medfly life stages on host plants in a manner that minimizes potential exposure and associated risks to nontarget species.

Malathion is an organophosphate pesticide whose mode of toxic action is primarily through acetylcholinesterase inhibition (Klaassen et al., 1986; Smith, 1987). The toxicity of malathion is very slight to moderate for mammals and birds. For fish, the acute toxicity of malathion varies from moderately toxic to some species of fish to very highly toxic to other species (Beyers et al., 1994; Mayer and Ellersieck, 1986; FS, 2008). Malathion is moderately to very highly toxic to most aquatic invertebrates on an acute basis, depending on the sensitivity of the species. Spinosad has low to moderate toxicity to wild mammals and birds. Spinosad toxicity to fish is moderate, while aquatic invertebrates are more sensitive in acute and chronic exposures. Toxicity to terrestrial invertebrates is variable; however, spinosad is considered highly toxic to honey bees.

Risks to nontarget species from the use of either malathion or spinosad baits are anticipated to be negligible because the proposed use pattern (targeted, hand application of the bait) results in a low potential for

exposure to most taxa. The bait applications attract only a small number of invertebrate species other than Medfly.

The release of sterile Medflies over the eradication zone will occur after the spinosad treatment has lowered the invasive Medfly population, and thus reduced the population of sexually mature female Medflies. SIT is expected to have no adverse effect on nontarget species.

The sealed methods for methyl bromide application are designed to protect nontarget species by preventing their exposure to the pesticide (APHIS, 2007 and 2002). Potential cumulative impacts of methyl bromide released to the global environment are considered in section 6 of this chapter.

Conservation areas in Cabo Rojo provide important habitat for a wide variety of wildlife that cannot be seen anywhere else in the United States. The Cabo Rojo National Wildlife Refuge, Cabo Rojo Salt Flats, and Laguna Cartagena National Wildlife Refuge lie near the current Medfly program area. The Cabo Rojo National Wildlife Refuge includes tracts of secondary forest, grassland, and brush habitats. The Cabo Rojo Salt Flats, under private ownership, are a 1,300-acre system of saline lagoons, salt flats, and mangrove swamps adjacent to the Cabo Rojo National Wildlife Refuge. The Cabo Rojo Salt Flats are the most important stopover site for migratory shorebirds known in the Caribbean. APHIS' Medfly programs are designed to prevent the introduction of program chemicals into nontargeted areas. No program chemical applications will be permitted at these sites or within refuges or other protected areas without coordination with refuge managers. Aerial SIT and surveillance trapping will continue, and fruit stripping by hand will be undertaken if Medfly detections occur at such locations. Pesticide bait applications will only be used if applications can be made without resulting in adverse impacts to protected species and habitats within the refuges.

a. Migratory Birds

The Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703–712) established a Federal prohibition (unless permitted by regulations) to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird.

Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," directs Federal agencies taking actions with a measurable negative effect on migratory bird populations to develop and

implement a memorandum of understanding (MOU) with the U.S. Fish and Wildlife Service (FWS) which promotes the conservation of migratory bird populations. On August 2, 2012, an MOU between APHIS and FWS was signed to facilitate the implementation of this Executive order.

The Cabo Rojo National Wildlife Refuge, including the Cabo Rojo Salt Flats (a potential Western Hemisphere Shorebird reserve), provides valuable habitat for migratory birds. According to the Cabo Rojo National Wildlife Refuge website (available at this link: FWS Refuge Profile 41521), some of the bird species present on the refuge include the prairie warbler, northern parula, Cape May warbler, and resident bird species include the Puerto Rican tody, Adelaide's warbler, Caribbean elaenia, turpial, and the endangered yellow-shouldered blackbird and piping plover. Each year, more than 40,000 shorebirds use the Cabo Rojo Salt Flats during their migration between North and South America. The Cabo Rojo National Wildlife Refuges Bird Checklist (USGS, 2013)), lists approximately 150 bird species in either Cabo Rojo Rojo National Wildlife Refuge or Cabo Rojo Salt Flats that are either endemic, endangered, exotic, or known to nest in those locations.

APHIS evaluated the proposed Medfly program in terms of potential impact on migratory avian species. Implementation of the preferred alternative is not expected to have any adverse effect on migratory birds or their flight corridors.

b. Endangered Species Act

Section 7 of the Endangered Species Act (ESA) and ESA's implementing regulations require Federal agencies to consult with FWS and/or the National Marine Fisheries Service to ensure that their actions are not likely to jeopardize the continued existence of threatened or endangered species, or result in the destruction or adverse modification of critical habitat. APHIS coordinates with the appropriate FWS Ecological Services Field Office before implementing Medfly program activities. FWS reviews maps of the quarantined area, and notifies APHIS if listed species are present in the program area. If listed species are present, APHIS implements protection measures for those species as approved by FWS.

APHIS initiated emergency consultation with the FWS Caribbean Ecological Services Field Office in Boquerón, Puerto Rico regarding the proposed eradication program. FWS reviewed maps of the currently infested area where program activities are expected to occur. FWS indicated that the Cabo Rojo area is designated critical habitat for the yellow-shouldered blackbird, a federally listed endangered species. The species nests from May to July in mangrove forests and coastal forested

areas, including palm tree plantations (cocotales). Because the currently infested areas are within residential settings and the application of the pesticide bait is localized and targeted, FWS does not foresee any adverse effects to the yellow-shouldered blackbird or its critical habitat. FWS recommends that APHIS closely coordinate Medfly eradication efforts with the Puerto Rico Department of Natural and Environmental ResourcesYellow-shouldered Blackbird Project.

APHIS submitted a biological assessment to the FWS Caribbean Ecological Services Field Office that assessed the potential effects of activities of the eradication program in the municipality of Cabo Rojo regarding species that are listed as endangered or threatened, and their designated critical habitats. APHIS determined that the eradication program will have no effect on the West Indian manatee, Puerto Rican nightjar, green, leatherback, and hawksbill sea turtles, pelos del diablo, beautiful goetzia, higo chumbo, palo de rosa, cóbana negra, bariaco, *Aristida chaseae, Catesbaea melanocarpa* and its critical habitat, *Lyonia truncata* var. *proctorii,* and *Vernonia proctorii*. APHIS has also determined that the eradication program may affect, but is not likely to adversely affect, the Puerto Rican plains pigeon, yellow-shouldered blackbird, Puerto Rican boa, and *Eugenia woodburyana*. APHIS requested FWS concurrence with these determinations, and received a concurrence letter dated March 30, 2015.

Should the program area expand or further outbreaks be detected that are not considered herein, APHIS will consult with FWS and other appropriate agencies, as necessary.

5. Environmental Quality

The principal environmental quality concerns are for the protection of air quality, water quality, and the minimization of the potential for environmental contamination. In relation to preserving environmental quality, program pesticides remain the major concern for the public and the program. Although program pesticide use is limited, especially in comparison to other agricultural pesticide use, the proposed action would result in a controlled release of chemicals into the environment. The fate of those chemicals varies with respect to the environmental component (air, water, or other substrate) and its characteristics (temperature, pH, dilution, etc.). The half-life of a compound is the time required for half of the compound to break down in the environment. Half-lives can vary widely based on environmental factors. The amount of chemical remaining after a half-life will always depend upon the amount of the chemical originally applied. It should be noted that some chemicals may degrade into compounds of toxicological significance (NPIC, 2009).

The environmental fates of spinosad, malathion, and methyl bromide are outlined below. At the time of preparation of this EA, only malathion and

methyl bromide are registered for use against Medfly in Puerto Rico. APHIS is seeking a Puerto Rico-use registration for spinosad. (Refer to EIS1 and EIS2 (APHIS, 2001 and 2008) and the risk assessments (APHIS, 2014a, 2003, 1999a, 1998a and 1998b) for more detailed consideration of these program pesticides' environmental fates.) The ground-spray bait ingredient, protein hydrolysate, is expected to have minimal impacts to environmental quality based on its use pattern and rapid degradation, and would not result in impacts to environmental quality beyond those described for the following chemicals.

- **Malathion** has reported half-lives in soil ranging from 1 to 25 days. It is considered to be very mobile in most soil types. Residues decline rapidly due to volatilization, binding to soil, uptake by plants, and metabolism by soil microbes. Malaoxon is a toxic and primary metabolite, and may form when malathion is deposited on dry soil or hard, dry surfaces; it is less stable than malathion and can be quickly degraded to non-toxic metabolites.

  Half-life on foliage of various fruits, vegetables, alfalfa, and grass ranged from less than 1 to nearly 9 days. Residues are lost from the plants due to evapotranspiration. Following foliar application, researchers found unmetabolized malathion residues in vegetative portions of plants; malaoxon made up $\leq$ 1% of residues.

  The half-life of malathion in water was estimated as 1.65 days at pH 8.16, and 17.4 days at pH 6.0. It is expected to exist primarily in the water column, and not bind to sediments. Malathion may dissolve in rainwater and be carried in runoff from the application site. Malathion has been detected in surface water and ground water; concentrations have been found at levels exceeding the aquatic-life benchmark dose. Malathion has not been detected in treated drinking water. Microbial degradation of malathion is believed to occur in seawater. The half-life of malathion during photodegradation in water is estimated to be 11.6 minutes. Malathion in the vapor phase has been detected in samples of air, fog, rain, and snow; researchers speculate volatilization and aerial transport during application (NPIC, 2009).

- **Methyl bromide** (MB) will not be used as an eradication treatment, however, may be employed as a regulatory treatment. MB volatilizes into air from soil and water, and is known to contribute to stratospheric ozone depletion. The volatilization half-life for MB from surface water ranges from 3.1 hours to 5 days. The degradation half-life of MB in water ranges from 20 to 38 days, depending on temperature and pH. Volatilization of MB from surface soil is rapid, with a half-life ranging from 0.2 to 0.5 days. The degradation half-life of MB in soil ranges from 31 to 55 days. MB has a low affinity to bind to soils, but

is not considered a major contaminant of ground water (NPIC, 2000). The small quantities used to treat for Medfly disperse when fumigation chambers are vented. See section 6 of this chapter regarding MB's potential cumulative impacts to the environment.

- **Spinosad** is not considered mobile in soil; it adsorbs strongly to soil particles and is unlikely to leach to great depths. Dissipation half-lives for spinosad in the field may last 0.3 to 0.5 day. It is photodegraded quickly on soil exposed to sunlight. Spinosad is quickly metabolized by soil micro-organisms under aerobic conditions, and has a half-life of 9.4 to 17.3 days. Spinosad is not sensitive to hydrolysis, however, aqueous photolysis is rapid in natural sunlight (half-life of less than 1.0 to 1.6 days), and is the primary route of degradation in aquatic systems exposed to sunlight. Under anaerobic conditions, the degradation rate is slower, between 161 and 250 days. Spinosad has a half-life of 2.0 to 11.7 days on plant surfaces. After initial photodegradation, residues are available for metabolism by plant biochemical processes. Effects from residues of individual treatments are no longer detectable in environmental substrates within a few weeks of application (APHIS, 2014a; Kollman, 2003).

Urban and agricultural runoff may flow directly into local waters, picking up trash, dirt, chemicals, and other contaminants along the way. The Cabo Rojo Medfly eradication plan calls for one type of outside application—ground-based spraying of spinosad or malathion bait to host trees and other plants. This targeted method of application is designed to minimize the potential for harmful introduction of program chemicals to local water bodies.

If treatment may occur in close proximity to a body of water, where pesticides may be directly discharged into the water, PRDA will analyze the environmental setting and establish site-specific best-management practices to follow. Mitigation measures will be applied to protect marine and freshwater resources. Program personnel will maintain a minimum distance of 200 meters from surface water and, when applying pesticides, will adhere to label direction, local and Federal laws, and recommendations of environmental compliance staff. Water body contact is not anticipated in Medfly eradication programs.

The alternatives were compared with respect to their potential to affect environmental quality. Risk to environmental quality is considered minimal, as a well-coordinated eradication program using IPM technologies is expected to result in the least amount and safest use of chemical pesticides overall. The no action alternative and the quarantine and commodity certification alternative would likely result

in broader and more widespread use of pesticides by homeowners and commercial growers, with correspondingly greater potential for adverse impacts.

The proposed program area was examined to identify characteristics that would tend to influence the effects of program operations. Potentially sensitive areas were identified, considered, and accommodated, as necessary, through special selection of control methods and use of specific mitigation measures. Allowances were made for the special site-specific characteristics that would require a departure from the standard operating procedures. The approaches used to mitigate for adverse impacts to bodies of water are described in EIS1 (APHIS, 2001).

6. Cumulative Impacts

This section considers the potential of the alternatives to cause cumulative impacts on the human environment. Federal non-actions and Federal actions limited to quarantine and commodity restriction are expected to result in the cumulative impacts that could arise from uncontrolled Medfly infestations in the United States. APHIS considered implementation of the preferred alternative in the context of, and in conjunction with, other pest insect eradication and quarantine projects in the program area, as well as other actions and activities known to be affecting the human environment.

Current and future Puerto Rico Medfly programs could potentially be merged into one larger program area. When a Medfly eradication program is combined with trapping and eradication actions in other Puerto Rican municipalities, a beneficial cumulative impact on the environment is expected, namely, less Medfly damage to fruit and fewer chemical treatments due to the reduction in Medfly populations.

Trapping and surveys for Medfly are ongoing in Puerto Rico's fruit fly detection and monitoring program.

Due to restricted application, the passage of time, and the prevailing weather conditions, no chemical residues are expected to remain from the Cabo Rojo Medfly program that could result in additive or synergistic chemical effects with chemical applications for other pest eradication programs.

Care should be taken when multiple pest species in the same area are targeted for treatment using the same chemical. APHIS and PRDA Medfly program directors are collaborating with APHIS and PRDA planners of an Old World bollworm (OWB) program under development, in order to prevent synergistic or cumulative impacts. Treatment options being considered for OWB include spinosad and imidicloprid formulations. The

OWB program is expected to be implemented in the Mayaguez Municipality, with no treatments overlapping the Cabo Rojo Medfly program.

Malathion is an organophosphate and may be formulated as dusts, wettable powders, liquids, or emulsions. Thousands of products containing malathion are registered for use in the United States (NPIC, 2010). Spinosad, although approved for organic production and as a replacement for certain organophosphates, has multiple registered food and non-food uses. Currently, spinosad is found in over 80 registered pesticide products. Many of these are used on agricultural crops and ornamental plants. Spinosad is currently employed in a variety of U.S. pest control efforts, including the control of termites and the European grapevine moth. Other formulations are used in and around buildings, in aquatic settings, and as seed treatments. Spinosad products are commonly sprays, dusts, granules, and pellets. Some of these products are approved for use in organic agriculture. Spinosad is also found in some drugs regulated by the U.S. Food and Drug Administration, to control head lice on people, and fleas on dogs and cats (APHIS, 2014a; NPIC, 2014).

Implementation of a Medfly eradication program could lead to an increase in chemical use, and the possible overlap of APHIS and non-APHIS program treatments. APHIS inquiries during the preparation of this EA have uncovered no additional active or planned programs in Puerto Rico which may employ treatments that could combine with Cabo Rojo program treatments to have a cumulative impact on the human environment.

APHIS has determined that uses of MB for fruit fly quarantine treatments pose negligible potential for cumulative impacts to the environment. For information on potential depletion of the ozone layer related to MB released into the atmosphere, see the “Rule for the Importation of Unmanufactured Wood Articles from Mexico, with Consideration for Cumulative Impact of Methyl Bromide Use, Final Environmental Impact Statement” (APHIS, 2002), and subsequent analyses, such as the “Importation of Solid Wood Packing Material, Supplement to the Final Environmental Impact Statement” (APHIS, 2007).

Additional actions may be implemented in this program, including additional quarantines and regulatory treatments. The anticipated use of these treatments is considered to pose minimal risk to the human environment, as determined in EIS1 and EIS2 (APHIS, 2001 and 2008), and the associated nontarget species and human health risk assessments (APHIS, 2014a, 2003, 1999a, 1998a, and 1998b).

There are no significant cumulative impacts anticipated as a consequence of implementing the preferred alternative or its component treatment

measures. The preferred alternative is designed to avoid overlapping chemical treatment areas, and to prevent nontarget exposure until pesticide residues have weathered to nontoxic levels. Based on APHIS' review of the context and intensity of the existing, ongoing, and potential future treatments, there are not expected to be any cumulative, synergistic, or residual impacts to the human environment resulting from this Medfly eradication program.

IV. Agencies and Individuals Consulted

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USCB—See U.S. Census Bureau

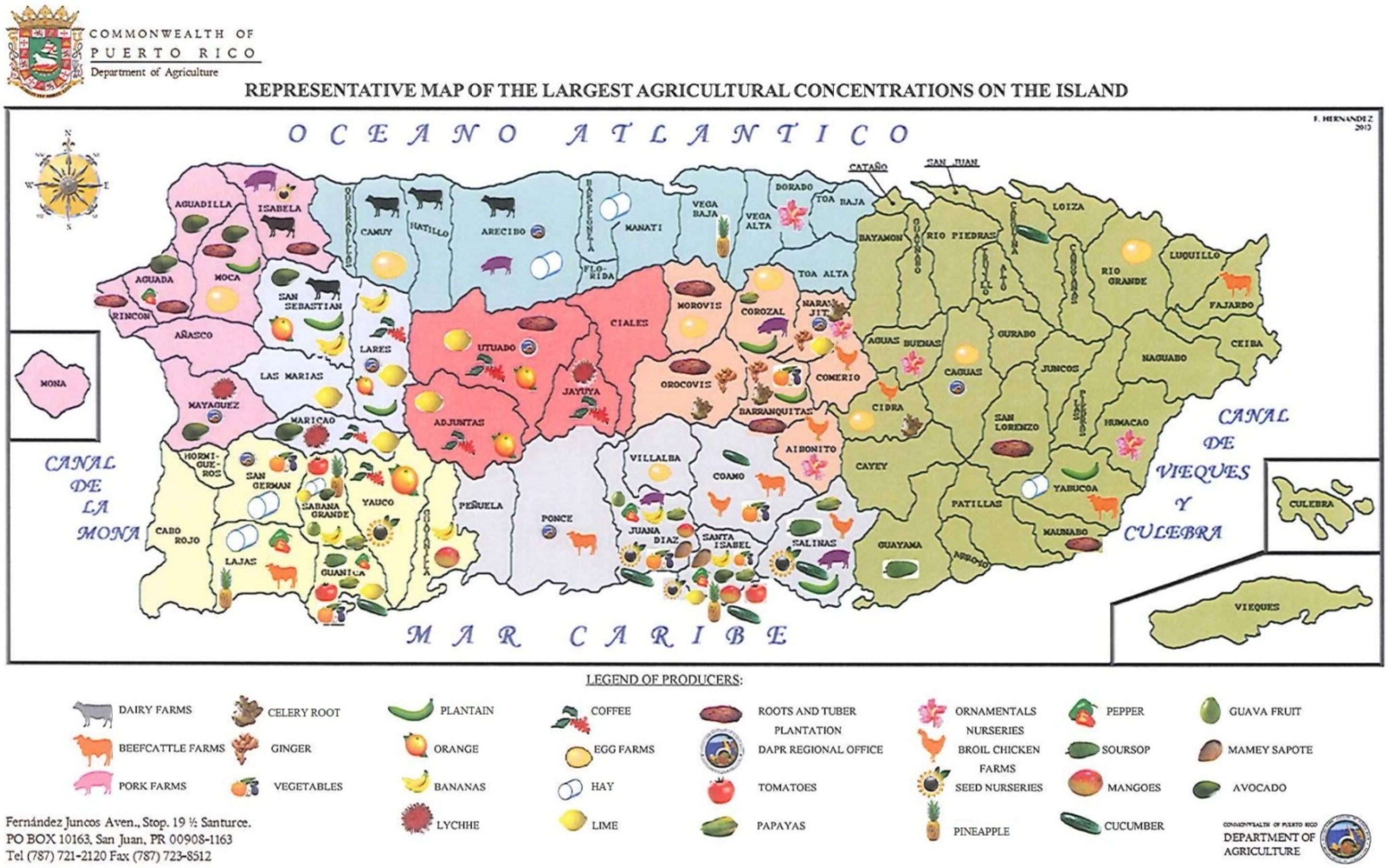
USGS—U.S. Geological Survey

USDA—See U.S. Department of Agriculture

Appendix A. Cabo Rojo Proposed Medfly Quarantine Area

The proposed Medfly quarantine in cabo Rojo
(Source: USDA–APHIS–PPQ)

Appendix B. Agricultural Production in Puerto Rico by Municipality



Appendix C. Spatial Data Resources Used from Outside of APHIS to Prepare This Document

The following resources were used by USDA-APHIS-PPD-ERAS in preparing spatial data analyses of the proposed Cabo Rojo Medfly program in the Commonwealth of Puerto Rico:

Web-based mapping application for environmental assessments:

- **NEPAssist (Data source for waters, superfund sites, historic sites, schools, demographics):**
  - http://nepassisttool.epa.gov/nepassist/entry.aspx

For information on—

- **National wildlife refuges:**
  - http://viewer.nationalmap.gov/
- **Critical habitat:**
  - http://ecos.fws.gov/crithab/
- **Migratory birds, wetlands:**
  - http://ecos.fws.gov/ipac/
- **Archeological sites:**
  - http://en.wikipedia.org/wiki/National_Register_of_Historic_Places_listings_in_western_Puerto_Rico#Cabo_Rojo
- **Ground water contamination:**
  - http://www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=PR
  - http://www.epa.gov/Region2/superfund/npl/0206319c.pdf
- **Impaired water bodies:**
  - http://oaspub.epa.gov/tmdl/attains_waterbody.control?p_list_id=PRWR77A&p_cycle=2012&p_report_type
  - http://iaspub.epa.gov/tmdl_waters10/attains_waterbody.control?p_list_id=PRSR69A1&p_cycle=&p_report_type=
  - http://ofmpub.epa.gov/tmdl_waters10/attains_waterbody.control?p_list_id=PRWQ71A&p_state=PR&p_cycle=2012