United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Name of Property

County and State

Name of multiple property listing (if applicable)

Section number _____ Page _____

SUPPLEMENTARY LISTING RECORD

NRIS Reference Number: 16000853 Date Listed: 12/13/2016

Property Name: Sistema de riego de las tres haciendas
(Waterworks in Puerto Rico, 1840-1898 MPS)

County: Santa Isabel Municipality State: PR

This property is listed in the National Register of Historic Places in accordance with the attached nomination documentation subject to the following exceptions, exclusions, or amendments, notwithstanding the National Park Service certification included in the nomination documentation.

Signature of the Keeper

12-13-2016
Date of Action

Amended Items in Nomination:

Section 8: Criteria

Criterion D is hereby deleted. The nomination does not address the significance of the irrigation system under Criterion D. While there are archeological elements present, some of which are disturbed, there are no research questions presented for which future investigation might yield important answers.

Section 8: Area(s) of Significance

Architecture and Archeology are hereby deleted as areas of significance. The property is eligible under Criterion C for its significance in demonstrating a sophisticated 19th century engineering solution of water distribution problems. It is not inherently architectural in nature. And, since Criterion D is not sufficiently addressed in the nomination, significance in archeology is not demonstrated at this time.

The Puerto Rico State Historic Preservation Office was notified of this amendment.

DISTRIBUTION: National Register property file; Nominating Authority (without nomination attachment)

United States Department of the Interior
National Park Service

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National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in National Register Bulletin, *How to Complete the National Register of Historic Places Registration Form.* If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions.

1. Name of Property

Historic name: Sistema de riego de las tres haciendas

Other names/site number: SI-53; SI0200031

Name of related multiple property listing: Going with the Flow: Waterworks in Puerto Rico, 1840-1898.

(Enter "N/A" if property is not part of a multiple property listing)

2. Location

Street & Number: South of Highway PR-52, north and on PR-1, west and east of PR-153.

City or town: Santa Isabel State: Puerto Rico County: Santa Isabel

Not for publication [N/A] Vicinity [X]

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this [X] nomination [] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60.

In my opinion, the property [X] meets [] does not meet the National Register Criteria. I recommend that this property be considered significant at the following level(s) of significance: **[] national [X] statewide [X] local**

Applicable National Register Criteria: **[X] A [] B [X] C [X] D**

Cariangeli León Moraza, Esq. SHPO/Director

Signature of certifying official/Title:

10/24/2016

Date

Puerto Rico State Historic Preservation Office

State or Federal agency/bureau or Tribal Government

In my opinion, the property [] meets [] does not meet the National Register criteria.

Signature of Commenting Official **Date**

Title **State of Federal agency/bureau or Tribal Government**

4. National Park Service Certification

I, hereby, certify that this property is:

[✓] entered in the National Register.
[ ] determined eligible for the National Register.
[ ] determined not eligible for the National Register.
[ ] removed from the National Register.
[ ] other, (explain):

Signature of Keeper

12.13.2016

Date of Action

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5. Classification

Ownership of Property (Check as many boxes as apply)

- [] Private
- [] Public-local
- [X] Public-state
- [] Public-federal

Category of Property (Check only **one** box)

- [] Building(s)
- [X] District
- [] Site
- [] Structure
- [] Object

Number of Resources within Property (Do not include previously listed resources in the count.)

Contributing	Noncontributing	
0	0	Buildings
1	0	Sites
7	0	Structures
0	0	Objects
8	0	Total

Number of contributing resources previously listed in the National Register N/A

6. Function or Use

Historic Functions (Enter categories from instructions.)	**Current Functions** (Enter categories from instructions.)
AGRICULTURE/irrigation facility	Not in use

7. Description

Architectural Classification (Enter categories from instructions.)

No style.

Materials (enter categories from instructions.)

Principal exterior materials of the property: Brick, stone, concrete, other

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Description

Summary Paragraph (Briefly describe the general characteristics of the property, such as its location, type, style, method of construction, setting, size, and significant features. Indicate whether the property has historic integrity.)

The irrigation system of the three haciendas (*Sistema de riego de las tres haciendas*) consists of a set of structures that were built between 1846 and 1886 by landowners from Santa Isabel, to transport water from the Coamo River to the fields of their sugar cane plantations; Florida, Santa Isabel, and El Destino. Built in brick, stone and lime mortar masonry with concrete plastering, the system consists of seven structures: a dam on the Coamo River, an inlet for storm, or torrential waters (*toma de aguas torrenciales*), a low (*estiales*) and seasonal (*estacionales*) waters module, a main supply channel with underground and open sections, three main branch lines which supplied each of the haciendas, (one of them with a stemming sub-branch) and a site, the remnants of a water distribution module. The main supply channel and the three branch lines are characterized by not presenting side locks, except for those added when this system was integrated into the Irrigation District of the Southern Coast (*Distrito de riego de la costa sur*), built between 1908 and 1914. The *Tres haciendas* system runs for 9.7 km through the coastal plain of Santa Isabel, using only gravity to transport the water through a set of underground, open, and elevated channels. The system is not in use since the 1990s which has resulted in some deterioration of its components. It presents some modifications and repairs dating to the 20th century, when the canals were integrated to the newer irrigation system. More recently, sections of the system have been impacted by modern agricultural machinery, and one of its key components, the distribution module, was partially demolished, albeit under archaeological supervision. However, this is one of the most complete and well preserved irrigation systems of the 19th century in the southern coastal valley, and possibly of the island. The district possesses historic integrity, as it maintains its attributes of location, design, setting, materials, feeling, workmanship and association.

Narrative Description (Describe the historic and current physical appearance and condition of the property. Describe contributing and noncontributing resources if applicable.**)**

The cultivation and processing of sugar cane depends heavily on water. To increase production of the crop, landowners Juan Alomar, Pedro Juan Capó and Nicolás Marqués, owners of the Santa Isabel, El Destino and Florida *haciendas* (estates) respectively, acquired, in 1844, a concession to use the waters of the Coamo River to irrigate their lands. The chosen location for the construction of a dam, where the riverbed was solid rock - not gravel, was more than 4 kilometers away from their fields. In 1846 they financed the construction of the *Sistema de Riego de las Tres Haciendas* (Three Haciendas Irrigation system) with mostly their own money and some financial help from the Crown. This system involved the construction of a weir on the Coamo River, a low water intake and a supply channel for transporting water from the river to a distribution module 3.6 kilometers away. From the distribution module, each landowner was responsible for building the branch that would take the water to their land. Three branches and one sub-branch were built, which together measure 6 kilometers long. Figure 1 shows a representation of the system of the *Tres Haciendas* and the grounds it irrigated in 1866.

The network of channels transported water from the Coamo River through the coastal plain, using only gravity. This feat required the construction of an underground section, which reaches more than 4 m deep in some areas, as well as variations in the height of the channels to achieve a constant flow of water. The channels constructed above the surface were open, while those underground were covered by arched vaults.

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Detail of the sketch of the basin of the Coamo river, 1866 (AGPR Serie Aguas, Subserie Sistema de Riego, Caja 410, Legajo 21, Exp. 927).

To maintain the constant flow of water through gravity, open channels were partly or fully buried, or elevated from the surrounding ground by means of bases, buttresses and arches. This network has no gates along its route, except for certain end sections located at the fields to be watered.

The materials and method of construction for the components of the irrigation systems were thoroughly detailed in the Spanish legislation. For this reason, the entire construction of the *Tres Haciendas* Irrigation System is similar. The building materials that were used are ordinary brick, limestone or igneous river stones, masonry mortar composed of three parts sand and two parts lime for the foundations and walls, and concrete - made from hydraulic mortar with brick chippings or fine gravel in equal parts. The construction technique used for walls and floors consists of ordinary brick and stone masonry consolidated with lime mortar, and coated on the inside with concrete; and for the foundations, stone and well-compacted fragmented brick masonry, with or without mortar.

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On the left, view of barrel vaulted section of the supply channel, facing south. Right; view of the partially buried open channel of the Hacienda Destino, facing north.

Left; Channel of the Hacienda Florida, raised on arches. Center; Channel of the Hacienda Florida, elevated on a base (note black arrows). Right; Channel of the Hacienda Florida, raised using a staggered base.

Detail of the makeup and construction method for the Hacienda El Destino Channel. Left, the inside of the west wall of the channel, covered with concrete, with some exposed bricks. Note that the floor has lost its concrete plastering. On the right, exterior view of the same wall segment.

The type of masonry used in the irrigation channels varies depending on the elevation of the tops of the walls in relation to the ground surface. The walls or wall segments that are underground are built with stone, fragmented brick and mortar. The above-the-surface wall portions, or the tops of the walls, are completed with several rows of brick, laid in a stretcher bond, with some scattered stones, consolidated with mortar, and coated with concrete. In the sections where the channel runs completely above the surface the walls are constructed almost entirely in brick and mortar masonry, with very few scattered stones, and concrete coating both outside and inside. The channel floors are built with brick, placed horizontally, with concrete plastering.

This irrigation system was modified in the 1880s, when the addition of some structures to control the amount of water used were deemed necessary. However, the main modification happened in the early twentieth century, as technology for the processing of sugar cane was improved and the production model of the *haciendas* was replaced by the centralized sugar mill, the need for raw materials increased. This created the need for additional water, delivered to more fields that were located farther from the river. Thus, between 1908 and 1912, the Irrigation District of the South Coast is built with government funds. The *Tres Haciendas* Irrigation system was not abandoned, but modified and incorporated into the new system.

The modifications made to the system of the *Tres Haciendas* in the early 20th century mainly consist of the addition of secondary channels built of reinforced concrete, connected by sluice gates that were added to the walls of the nineteenth-century system channels. Other sluice gates were installed to fill ponds or to water the sugarcane fields by direct irrigation. Some sections of the *Tres Haciendas* irrigation system were fortified, either by using buttresses and constructing reinforced concrete beams, or they were reinforced or rebuilt with the same technique. The dam and the low and torrential water modules were also modified, as will be discussed in detail below.

The *Tres Haciendas* Irrigation System was partially in use until the 1990s, when it was abandoned. For its full length, repairs that were performed throughout its period of usefulness can be found. Some repairs include inscriptions with the dates in which they were made, such as December 15, 1961 or December 16, 1980.

After its abandonment, the irrigation system has deteriorated. Some segments of the vaulted channel have collapsed, as have walls of the open channels affected by agricultural activities. In urbanized areas, open channels have been filled with earth or covered, using sheet metal on which a layer of concrete was poured (Photo 8). In rural areas, open channels are hidden by the vegetation, filled with soil, or buried under mounds of dirt and even rubble.

On the left, view of the *Hacienda Destino* channel, facing west. White arrow shows a channel that was added when it became part of the Irrigation District. In the center, detail of added sluice gate. Right; reinforcement beam added to the *Hacienda Florida* Channel.

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Repairs with date inscriptions. On the left, repair on the supply channel dated 1961 and to the right, repair to the low and torrential waters modules, dated 1980.

On the left, collapsed section of the torrential waters inlet channel, looking southwest. On the right segment of the supply channel with side impact caused by agricultural machinery.

On the left, section of the supply channel covered with corrugated metal sheets and a slab of concrete. Arrows indicate the channel's route. To the right, supply channel in a backyard, filled with earth.

The most significant impact to the system has been the demolition of the distribution module as part of construction of the *Finca de Viento* project. Before its demolition in 2012, the structure was documented archaeologically, thus ensuring its preservation by record. Remains of its foundation lie underground, for which it is regarded as an archaeological site for the purposes of this nomination.

It is pertinent to mention that the *Tres Haciendas* Irrigation System was the subject of a Phase II archaeological assessment, conducted in 2011 by archaeologist Marisol Meléndez Maíz. In that study, the channels that are part of the district, as well as the water distribution module, were located and documented. In 2012, an archaeological documentation of several points of the irrigation system that would be impacted by the development of the *Finca de Viento* project was carried out (Freytes 2012 and Meléndez Ortiz 2012). Several of the photos and drawings included in this nomination come from these studies, with the consent of their authors.

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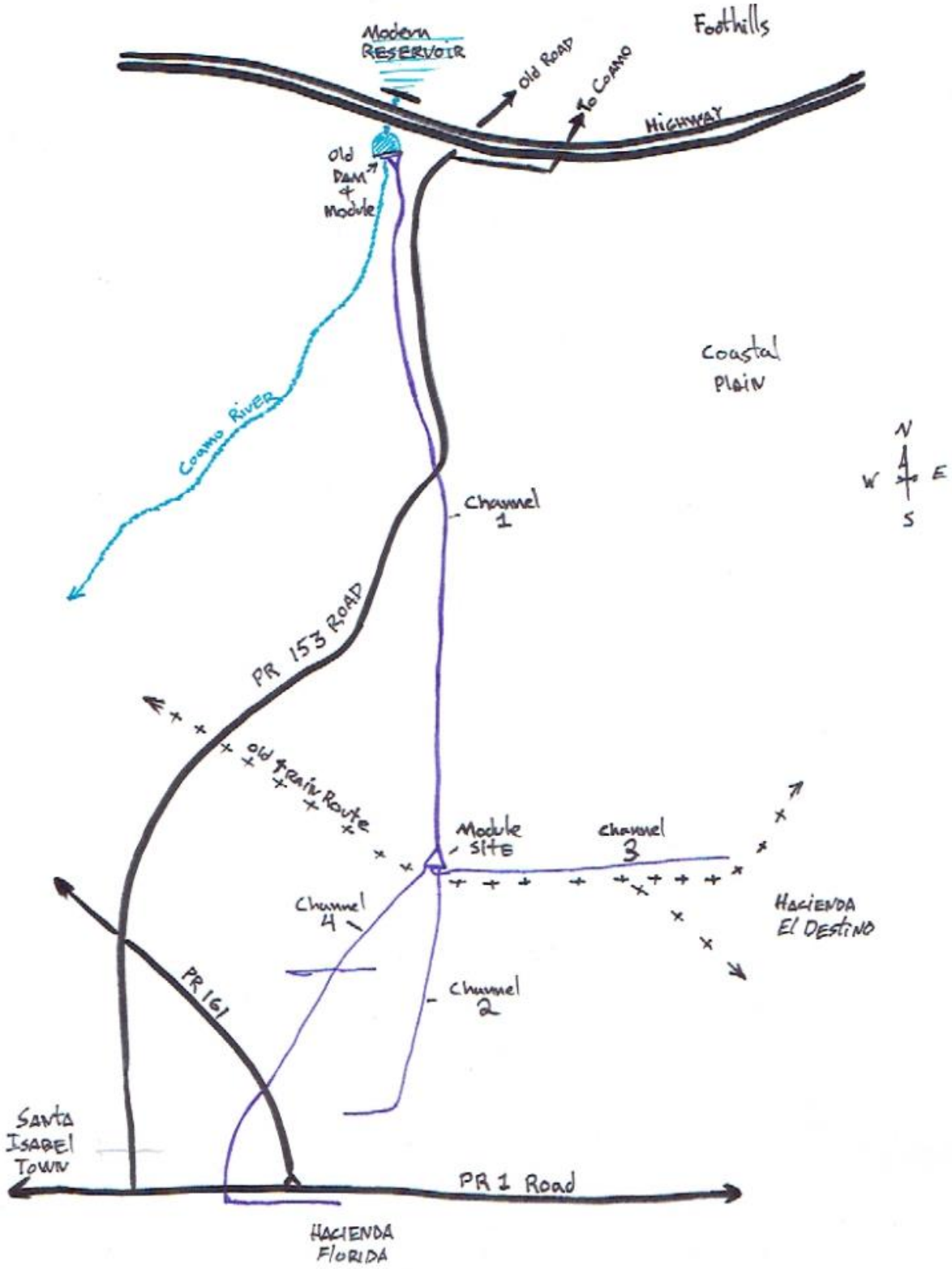
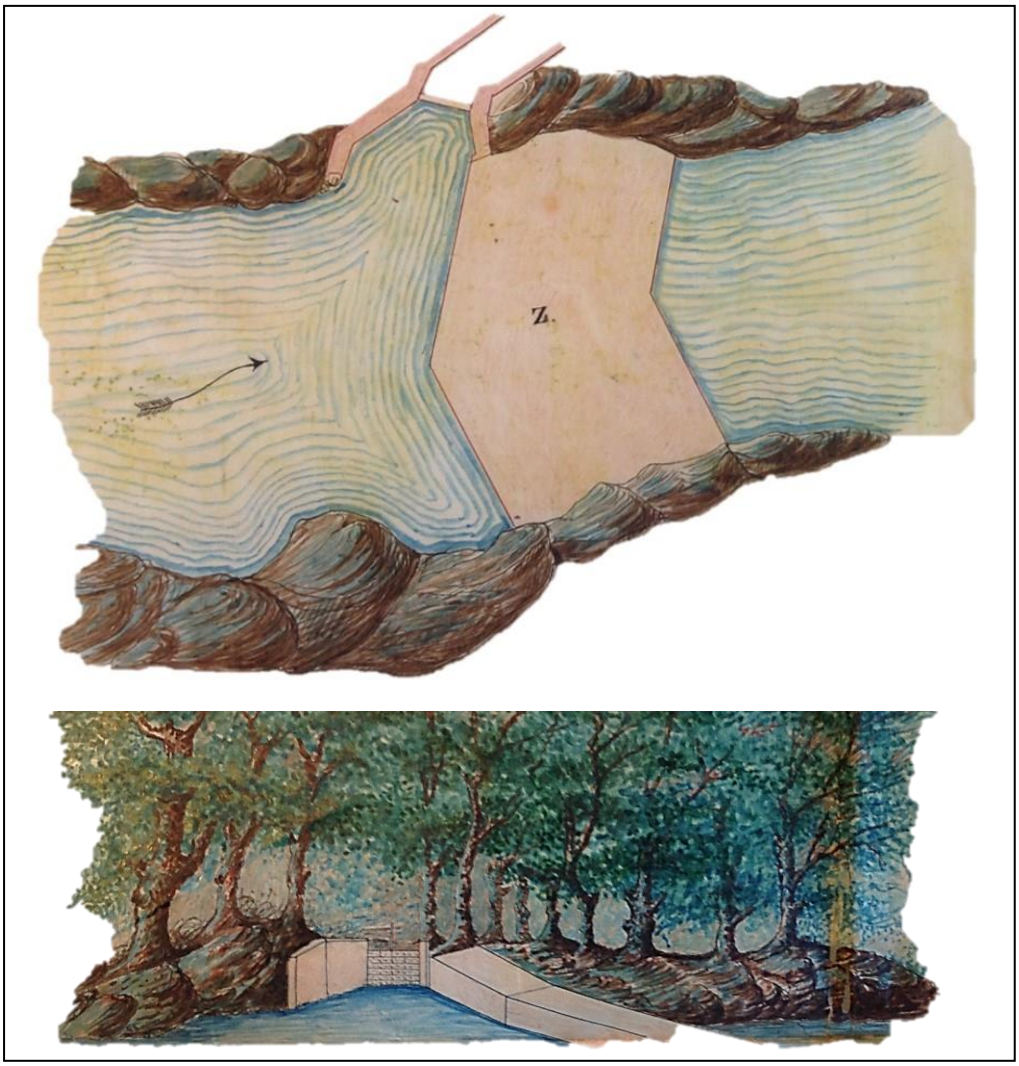


Sketch of the *Tres Haciendas* Irrigation System District

The properties that make up the *Tres Haciendas* Irrigation System, in the approximate chronological order in which they were built, are described below.

Dam

The dam is located in the *Guamá* sector of the Coamo River, in an area where the riverbed is made up of impermeable bedrock. It is a solid structure, 27 m long, stretching from one bank of the river to the other, forming an obtuse angle close to its center.



Plan and view drawing of the dam (Z) and the estiales (low-waters) intake in the *"Proyecto de riego en Santa Isabel de Coamo",* 1845 (AGPR, Aguas, Leg. 21A, Exp. 1223)

The dam has two evident construction stages. The original dam, a weir built in 1846, was built of masonry, as described. It is rounded on top, measuring between 1.8 and 2 m in width, with a height of 90 cm. The structure does not extend presently from bank to bank of the river, but begins in the low-waters module to the east and ends on a rock formation to the west, with a total length of 19 m. Subsequently, during the 20th century, the height of the dam was raised to 1.2 m, by building a concrete wall reinforced with spiral steel rod. The addition has a trapezoidal shape, with straight walls and a flat top, measuring 60 cm wide at the base and 30 cm on top,

with a height of 30 cm. Also during the 20th century, a sluice gate was added to the dam, it measures 1.5 m wide by 90 cm high. The frame for sluice gate was constructed of reinforced concrete, leaving a molding in which, according to local residents, wooden planks would be slid in to control the flow from the reservoir. This part of the dam does extend to the west bank of the river, with a total length of 27 m.

On the left, view the central area of the dam with the added opening for the sluice, seen upstream from the east bank. On the right; detail of the two construction phases of the structure: lower part built from brick masonry in the 19th century, and 20th century upper part of reinforced concrete.

The dam shows some deterioration, such as cracks and spalling. However, it is still in good condition, to the point that staff of the Division of Irrigation of the Electric Power Authority has shown interest in putting it to use again (personal communication; Eng. Estremera, April 2015). An important aspect of this component of the *Tres Haciendas* irrigation system is that it unequivocally conveys its historic significance at first sight.

Supply channel

Reservoir water, captured by the dam, was transported through a *Canal de abasto* (supply channel) or *Canal general*, traversing 3.6 km through the coastal plain of Santa Isabel, from the *toma de aguas estiales* (low-waters intake) to the distribution module. Water flowed by gravity from a height of 35 meters above sea level (masl), across a hill standing 38 masl, to the distribution module, which was at 18 masl. It is currently unknown whether there are remnants of the low-water intake, since two water management modules were built in its place. It would be necessary to implement an archaeological investigation to determine the presence of remnants and their integrity. In contrast, the supply channel, also known as Channel 1, is almost intact along its route, with some impacts that occurred after its use was discontinued in the 1990s. This structure has been archaeologically documented in at least four archaeological studies (Meléndez Maíz 2011, Freytes 2012, and Meléndez Ortiz 2012, 2015).

The supply channel can be divided into two main sections: to the north, a 1 km long stretch that runs underground, and to the south, an open stretch 2.6 km long. The underground section begins at the dam, following the east bank of the Coamo River, over bedrock, to delve underground at 25 meters south of its origin. It continues buried, reaching up to 4 meters deep, across a vacant lot and under the El Ojo community, gradually emerging until completely exposed in the backyard of a property located on Street #4 of that community. In this section, the channel is vaulted and measures 1.2 m high inside by 1.2 m of interior width.

The underground section of the supply channel has rectangular service manholes, intended to provide access to the interior of the structure for maintenance. Above surface they appear to consist of simple concrete boxes, with steel sheet metal covers secured with bolts. The interior is surprising, since it consists of a shaft with un-plastered brick walls, which extend to 4 m beneath the surface into the supply channel. The inner dimension of

the manholes varies, with an average of 1.8 m long by 1.7 m wide. Six of this structures were located, found in a vacant lot and on the sidewalks and backyards of the *El Ojo* Community. Most of them are in good condition, although partially filled with dirt, debris, and garbage. Only one such structure, located in the backyard of a house, presents a severe erosion of the bricks, both inside and outside. Some had their walls raised by using reinforced concrete. Their exterior height ranges from 63 cm to 1 m above the surface. It is estimated that many more of this manholes are yet to be identified.

On the left, entrance to the Supply channel at the low-waters module, looking south from within the inlet. In the center, vaulted segment of the supply channel that runs along the surface in the area of the dam. Notice the concrete plastering over the vault. On the right, view of the channel as it emerges to the surface, in the backyard of a property of the *El Ojo* Community. Note that the vault does not have plastering.

On the left, service manhole to the supply channel, located on a sidewalk of the *El Ojo* Community. In the center, detail of the service shaft inside a manhole. Right, manhole which features an advanced degree of damage by erosion, located in the backyard of a house.

The supply channel surfaces 1 km south of its origin and continues open. It again hides underground only at the crossing under road PR-153, which was the road between the town of Coamo and the port of Santa Isabel. The open channel crosses through the backyards in an urban area first, and then under structures that were built above it. Eventually it runs through farm fields, partially hidden by dense vegetation and mounds of dirt or rubble, ending at the distribution module.

The open section of the supply channel begins partially buried, with the top of the walls at ground level, and gradually rises over the surrounding terrain until set completely above the surface. It has straight sides and a flat bottom. Its average inner width is 1.2 m and its interior height measures up to 77 cm. The foundation was documented in several excavation units, where it reached 30 to 90 cm deep below the bottom of the walls, and projected from 4 to 9 cm from their exterior sides.

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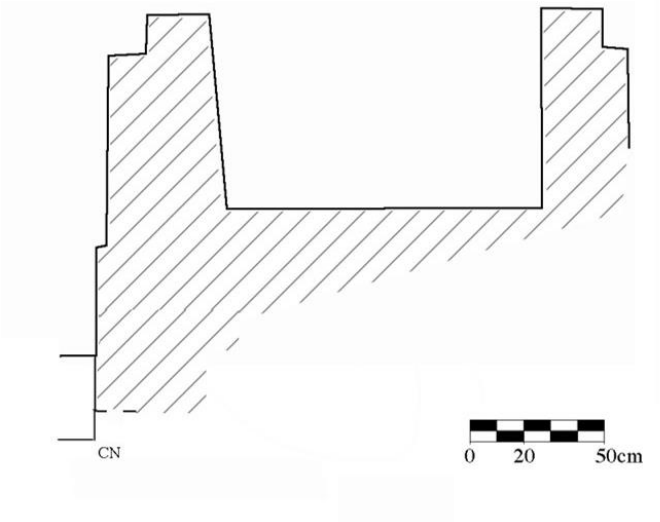
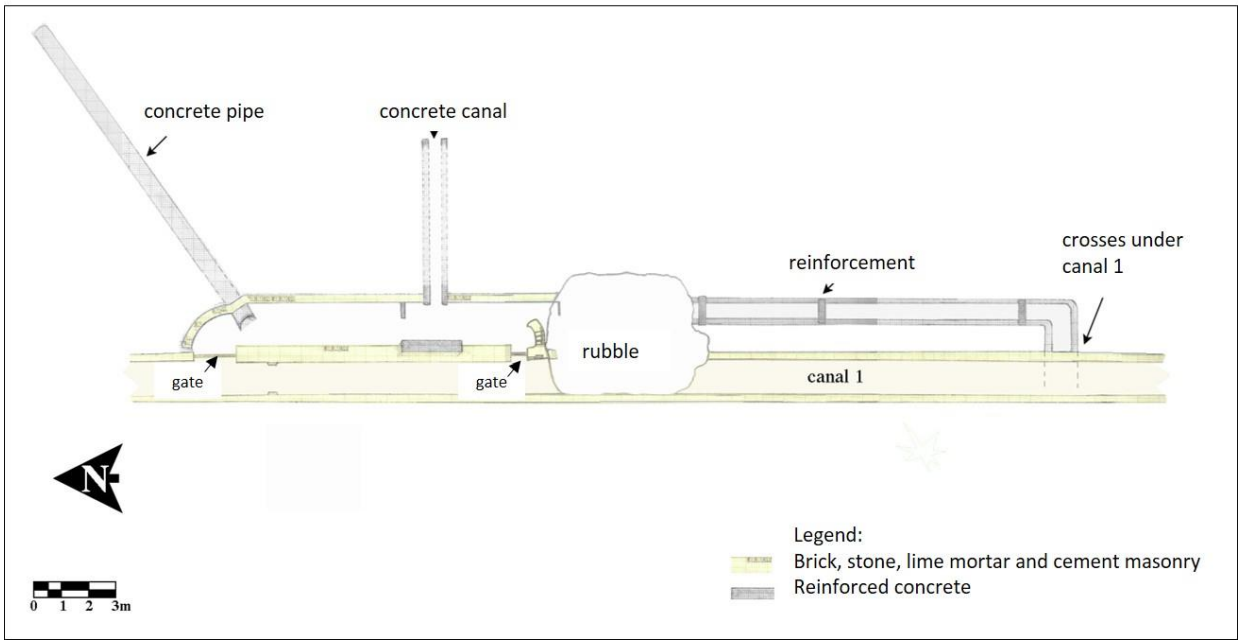


Outline of the open supply channel (from Meléndez Maíz 2011, drawing no. 7) and interior view.

Left, detail of outer side of the west wall and foundation of the supply channel, in an area where the open channel is buried. On the right, detail of outer side of the west wall and foundation, in an open section where the channel is above the surface.

The supply channel shows damage in areas where some wall segments or the vault have collapsed. The channel also presents some repairs and alterations, such as the construction of buttresses, the reconstruction of a 25 m section in reinforced concrete, the reconstruction of small wall segments or, the addition of concrete as reinforcement for walls. In the farming area, eight bridges or crossings were built, of reinforced concrete, to move vehicles and machinery back and forth over the channel. Finally, several sluice gates were added to the channel when it was integrated into the Irrigation District of the South Coast.



Floor Plan drawing of a segment of the supply channel which was modified as it was incorporated into the Irrigation District of the South Coast (adapted from Meléndez Maíz 2011: Drawing no. 4).

The supply channel is the better known portion of the *Tres Haciendas* irrigation system, because until the 1990s, for 700 m, it transported water through the backyards and under the houses of the *El Ojo* Community. Some residents still keep the channel open and in good condition, hoping that the water flows through it again someday.

Distribution module

The supply channel ends south at the distribution module, from where the water was divided and distributed through three branching channels, which were responsible for delivering the water to the fields of the *Santa Isabel, El Destino* and *Florida haciendas*. The structure was designed to withstand weight and lateral forces, since it was built on a foundation of stones, fragmented brick and lime mortar that was 60 cm deep and protruded 35 cm from the exterior of the walls. It had walls 60 cm wide and a buttress 94 cm wide by 1.80 m long.

In the exterior, the distribution module had more or less a rectangular shape, with dimensions of 13.5 m long by 7.5 m wide and 1.5 m high. The inside was deeper, reaching 1.95 m below the top of the walls. It was subdivided in three sections or *depósitos*[1], each with a sluice gate to control the flow of water to the branch channels, and a measuring gauge to indicate the water level. The supply cannel entered through the north, and the three branching channels exited south: The *Santa Isabel hacienda* channel was in the east, with a heading of 175 degrees, the *El Destino hacienda* channel in the middle, at an angle of 195 degrees, and to the west, oriented at 221 degrees, was the channel leading to *Hacienda Florida*.

[1] Individual rectangular chambers of approximately equal size.

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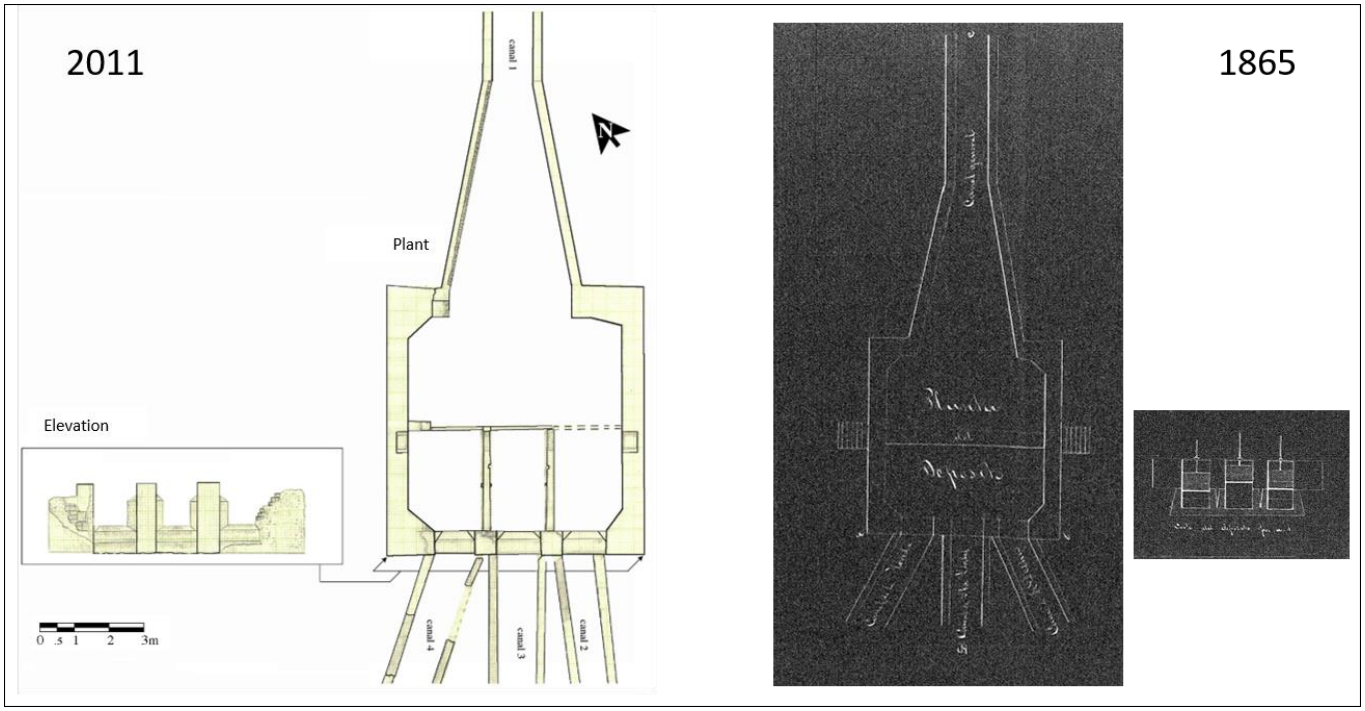
On the left, general view of the distribution module, during archaeological documentation works performed in 2012, looking south. On the right, view of the structure in 2011, looking northeast.



On the left, plan view and elevational drawing of the distribution module, by Meléndez Maíz in 2011. On the right, same, 1864 (AHN, Ultramar, Mapas y Planos, CIH, carrete E).

The imposing structure was demolished during the year 2012, as part of the construction work of the *Finca de Viento* project. It was documented in two archaeological studies (Meléndez Maíz 2011 and Meléndez Ortiz 2012). It is understood that beneath the surface there are still remnants of its foundations and the foundations of the channels associated with it. It is for this reason, and for the importance of this property as a geographical reference to the other components of the irrigation system, that it is included in this nomination as a contributing site.


On the left, view of the distribution module in 2011, facing southeast. On the right, current view (2016) of the area where the module was located.

Santa Isabel Hacienda Channel

The *Santa Isabel hacienda* channel, or Channel 2, transported the water from the distribution module a distance of 2.3 km to the fields of the *Hacienda Santa Isabel*. For 1.7 km, the channel runs southwards. In most of this stretch of its route, the top of the walls is level with the surface, with an inside depth of 50 cm. The only alteration observed in this segment is the addition of four reinforced concrete buttresses to the east wall.


On the left, a segment of the *Santa Isabel Hacienda* channel, with setback feature. Right; arched bridge.

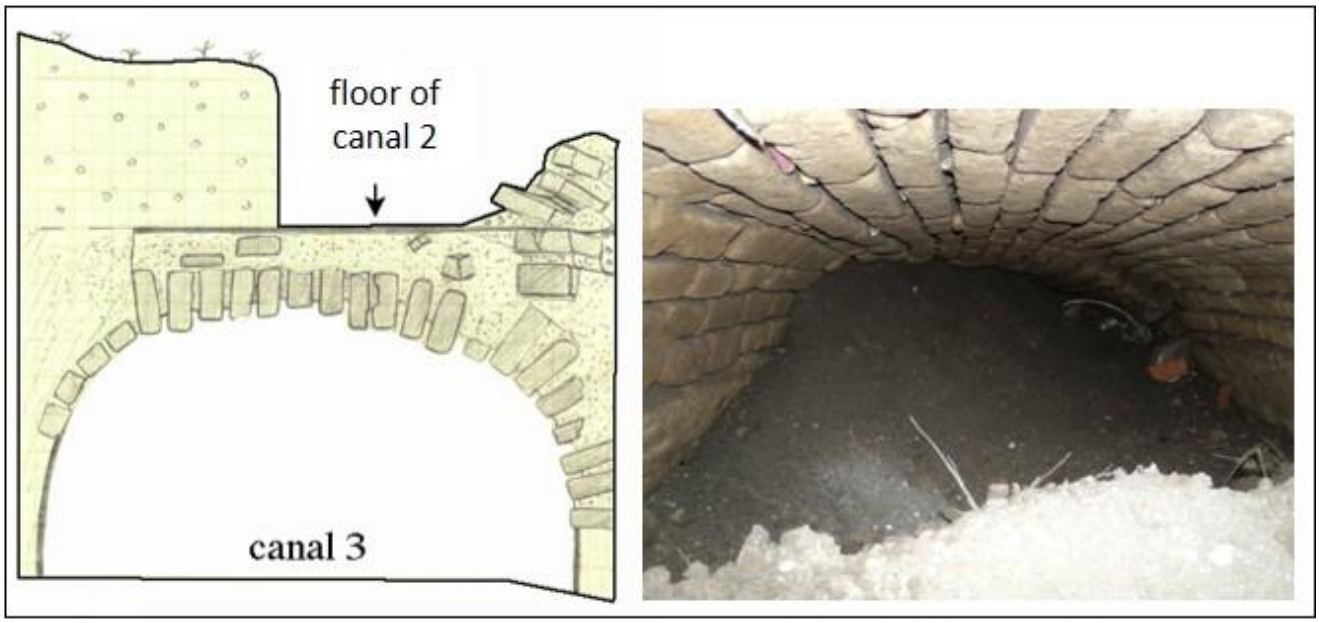
At 1.7 km south of the distribution module, the channel turns to 280 degrees, and continues for 625 additional meters. This section has at least four sluice gates, allowing irrigation of the land located to the south. Channel 2 is deeper here, reaching to 1 m inside, and its level relative to the surface rises. It begins with an 11 m segment where the channel has a 15 cm high setback, built with brick coursing at a stretcher and header bond.[2] Next, the

[2] A soga y tizón

channel continues elevated on a platform that has several buttresses and a brick arch. A manual steel sluice gate still survives where the channel turns west.

Hacienda El Destino Channel

The *Hacienda El Destino* channel, or channel 3, is an open aqueduct with a length of 1.04 km. It originates at the distribution module and runs southerly, over the surface, at a bearing of 195 degrees. At 47 m it enters underground and turns southeast, crossing under the *Santa Isabel hacienda* channel. This 56 m underground portion has a vault measuring 53 cm high by 114 cm wide. The brick floor of the *Santa Isabel Hacienda* channel rests on top of this vault, evidencing that they are contemporaneous. Back on the surface it is 75 cm wide and 50 cm high inside, again open, with the top of the walls at ground level. It continues eastward towards the *El Destino hacienda*.



Left; Profile drawing in which the relationship between the *Hacienda Santa Isabel* and the *Hacienda El Destino* channels can be seen (adapted from Meléndez Maíz 2011: drawing no. 12). On the right, inside view of the vault of channel 3.

At 450 m from its origin, Channel 3 is interrupted by a reinforced concrete wall that diverted the waters through a sluice gate into a parallel channel of the same build, designated Channel 3N. This construction was made when the system was integrated into the Irrigation District of the South Coast. The side by side channel was necessary because, around 1904, a stretch of 310 meters from the south wall of the channel was demolished to the ground level, to lay the railway line of the Aguirre Sugar Company. To the east of this detour, two additional sluice gates were built to supply water through other channels also built in the 20th century.

The *El Destino hacienda* channel is covered completely by dense vegetation and partially by dirt mounds. It is best preserved towards its western end, with intact sections, although filled with soil. The rest of the channel shows more impact, with only the wall footing and floor of the structure remaining at its eastern limit.

Left; photo of a segment of the channel of the *El Destino hacienda,* taken in 2012 after a wildfire cleared the vegetation. Right; area where a section of the canal was exposed in 2016 (marked with the black arrow), completely hidden by the vegetation.

Left; view of channels 3 and 3N, looking west. The remains of the *El Destino hacienda* channel is seen to the left, with its south wall flattened to ground level and channel 3N alongside, constructed soon after. In the right photo, detail of sleepers of the railway line, in situ, resting on the footing of the south wall of channel 3.

Hacienda Florida Channel

The last of the components making up the irrigation system of the *Tres haciendas* is the *Hacienda Florida* channel or Channel 4. This is the longest branch line, extending 2.5 km from the distribution module to the urban area of the town of Santa Isabel. It carried water by gravity through a relatively flat area, with a

difference in altitude of only 8 m (from 17 masl at the start to 9 masl at the end). Therefore, along its route, Channel 4 has variations that kept a constant flow of water throughout its full extent.

From the north, the channel begins partially buried, with the top of the walls level with the surface. It is 48 cm deep inside. From 163 m to 213 m from the starting point, Channel 4 is entirely above the surface, and even elevated on a masonry base. At a section located between 435 m and 595 m from the start, the channel is raised above the surface and supported by abutments located on both sides of the structure at 30 points. They are located at an interval of 4 to 7 m, with variable dimensions, and consist of triangular structures built with the same materials and construction technique as the channel. Here the channel is 68 cm deep. Between 635 m and 700 meters from the start, the channel rises again on a massive foundation. In this section, the channel walls feature a setback step formed by two rows of bricks coursed at a stretcher bond. Meanwhile, the cement has two levels: an upper level to 25 cm tall, made of stone and bricks bound with lime mortar, and a lower level measuring 30 cm, built of stones and fragmented bricks with no consolidating material. Between 666 m and 686 m from the start, the channel is elevated on four arches - one simple and three double arches. The area surrounding the arches is paved with stone to prevent soil erosion. The base continues to be massive and with staggered sides.

Left; view of the *Hacienda Florida* channel at its origin as it left the distribution module, facing northeast. Center; Detail of an abutment. Right; segment of the channel on arches. Note the stone pavement under the channel.

Beyond 800 m from the start, the *Florida hacienda* channel disappears for 700 m through a farm field and under road PR-161. It is unknown whether there are remnants below the surface. The structure was seen again to the north of the La Calambreña community, fringing the urban area of Santa Isabel, where it continues under the houses on the east side of the Antigua Vía street and a vacant lot. Here, the channel is at floor level, filled with dirt or covered with concrete. Then the channel continues southwards under road PR-1, turning east to proceed along the south side of said road. At the intersection with *A* Street-the road that lead to the old factory of the Florida hacienda- the channel delves underground in a structure similar to the one observed in the supply channel under road PR-153. A service manhole was also seen. The channel continues buried for 270 m, to re-emerge over the surface for an additional 250 m. At its final stretch, Channel 4 lies on a base which decreases in elevation as it continues eastward.

General views of the *Hacienda Florida* channel in the urban area of Santa Isabel. Left; covered channel through vacant lot and under a dwelling. Right; the channel as it appears along the south sidewalk of road PR-1, facing west.

Some segments of Channel 4 were modified during the 20th century. The modifications consist of the construction of six reinforced concrete beams to prevent the collapse of the walls, the reconstruction of a section of 10 m where two steel sluice gates were installed, with the knife gates operated by a lifting screw, and the installation of three gates which opened to a pool which is now dry.

The channel's condition in the urban area is unknown, since it is mostly below structures. At the final stretch, the channel is in fairly good condition, though full of trash and with some cracks that show attempted repairs with tar. The biggest impact in this area is caused by a gigantic *Fichus* tree that grows within the structure.

The *Hacienda Florida* channel has a perpendicular sub-branch, which extends east and west of it, with the intersecting point located 796 meters south of its origin. This sub-branch, named Channel 5, is oriented at 275 degrees and measures 294 m long. It has four sluices gates, two of the gates control the water flow into two reinforced concrete branches which continue southwards. A third sluice is made of galvanized steel, indicating that it is relatively late addition. The fourth sluice gate is located inside the channel. This channel is partially destroyed. In 2011, its eastern portion was impacted by the construction of a drainage ditch. Only the floor and the base of the walls of the channel remain in that portion.

Storm Waters Intake (*Toma de aguas torrenciales*)

The Santa Isabel, Florida and *El Destino haciendas* benefited from the low waters of the Coamo River for several decades. However, in view of the increase of cultivated cane fields, they requested to also take advantage of the storm waters from the river. This was granted in 1875. The *torrencial*es (storm water) intake was built upstream of the then existing *estiales* (low waters) intake. It featured a channel that delivered flood water to the supply channel. Because of the vegetation and sediment buildup in the area, there was no access to the entrance of this intake during the field inspection. A stretch of 27 m of the channel was identified, which ends abruptly against a single coursed brick wall. There, an aperture on the eastern wall of the supply channel received the flow of storm water. This intake channel is vaulted and is constructed in the same build as the rest of the system. It is smaller than the supply channel, measuring 1 m wide by 1 m high inside. An interesting

feature of this channel is that it is not straight, but meanders through the terrain. This is possibly due to the rocky terrain where it lies.

Left; view of the sub-branch, or Channel 5, facing west. Right; detail of the sluice gate.

Views of the torrential waters channel. Left; General view of the channels route, marked by the yellow dotted line. Right top; entrance into the supply channel facing west, and inside view of the torrential waters channel looking south.

Low waters and seasonal waters module (*Módulo de aguas estiales y estacionales*)

In 1885, the owners of the *Tres haciendas* requested a new concession, this time with the aim of separating the water from the *estiales* (low) and the *torrenciales* (storm) water inlets. In this way, and because of the

construction of other outlets in the same reservoir, ensuring that their need for water in times of drought would be met. In 1886 they are granted permission to build the *estiales* waters module. Subsequently they were authorized to build a division within the module to take advantage of *estacionales* (seasonal) water, which were to be separated from the torrential waters intake. The latter's threshold was also raised as a result of these works.

The *estiales and estacionales* waters module is located on the east bank of the river, adjacent to the dam where the *estiales* waters intake was. Of more or less rectangular shape, it measures 11 m long, and between 5 to 7 m wide. The structure is divided into two areas; to the west is the *estiales* waters intake module and east the *estacionales* water module, built later.

Four construction stages are noticed. Firstly, the *estiales* waters intake module was constructed, which consisted of a structure that collected water from the reservoir even in times of drought through a sluice gate and into a module where the amount of water was measured, to then continue through a second wooden gate through the Supply channel. The west wall of the module had different heights, allowing for the return to the river of waters in excess of those accorded.

A year later, the *estacionales* water module is added. It allowed for the harnessing of the additional water during the rainy season. This module also featured a gated intake to collect water from the reservoir, but with a higher threshold than that of the *estiales* module. This water would flow freely into the supply channel, for which part of the wall dividing the two modules was demolished. The footprint of the demolished wall segment is visible on the floor, and remnants of a wooden sluice gate at the entrance to the channel are visible in the floor and west wall. The first sluice gate was removed, replaced by another one which was built at the exit of the *estiales* water module.

Left, general view of the area of the low waters and seasonal waters modules. In the foreground we see the supply channel, with the module and the dam in the background. Right, view of the modules, showing the low waters module full of water on the left and the seasonal waters module on the right of the photo, facing north.

The structure was modified in the 20th century. The height of the walls was elevated by adding reinforced concrete walls. The *estacionales* (seasonal) water module was bypassed by demolishing a section of the central wall and the construction of a diagonal wall that closed the intake above the module. The waters from the two sluice gates at the reservoir now entered a single module. Several parallel rods were installed facing the inner sluice gate of the *aguas estiales* module to make a garbage trap. Finally, the two sluice gates facing the reservoir were walled up. The current condition of the area where the dam, module, storm water intake and supply channel begins is depicted on Figure 8.

Left and center; remnants of the wood frame of the inner sluice gate of the low waters module. Left; detail of the inner gate of the module, with part of the metal sluice and metal bars that created a garbage trap.

Despite the changes and impacts described, the *Tres Haciendas* Irrigation System retains some features of all seven aspects of integrity: location, design, setting, materials, workmanship, feeling, and association. The individual components of the system, with the exception of the distribution module, retain the essential features that made up their physical appearance during its period of significance, between 1846 and 1904. Essential components of the system, like the dam, modules and channels, are visible enough to convey their significance. Moreover, the relationships among the district's components are unchanged since its period of significance. As such, it can be concluded that the historic district retains its integrity.

Sistema de riego de las tres haciendas | Santa Isabel, Puerto Rico

Name of Property | **County and State**

Drawing of the dam and modules of the *Tres Haciendas* Irrigation System

Sistema de riego de las tres haciendas | Santa Isabel, Puerto Rico
Name of Property | **County and State**

8. Statement of Significance

Applicable National Register Criteria
(Mark "X" in one or more boxes for the criteria qualifying the property for National Register listing.)

- X **A** Property is associated with events that have made a significant contribution to the broad patterns of our history.
- ___ **B** Property is associated with the lives of persons significant in our past.
- X **C** Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- X **D** Property has yielded, or is likely to yield information important in prehistory or history.

Criteria Considerations
(Mark "X" in all the boxes that apply.)

Property is:

- ___ **A** Owned by a religious institution or used for religious purposes.
- ___ **B** Removed from its original location.
- ___ **C** A birthplace or a grave.
- ___ **D** A cemetery.
- ___ **E** A reconstructed building, object, or structure.
- ___ **F** A commemorative property.
- ___ **G** Less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance
(Enter categories from instructions.)

Agriculture
Engineering
Architecture
Archeology/Historic-Non-Aboriginal

Period of Significance

1844-1910

Significant Dates

1846
1873-1886
1910

Significant Person
(Complete if Criterion B is marked above.)

Cultural Affiliation

Spanish colonial

Architect/Builder

Statement of Significance Summary Paragraph (Provide a summary paragraph that includes level of significance, applicable criteria, justification for the period of significance, and any applicable criteria considerations.)

Of the many private irrigation works built in the southern coastal plain during the 19th century, the irrigation system of the *Tres Haciendas* is the one that has been documented in its entirety, and the most complete identified at the present time. This irrigation system is outstanding in that it has an extensive and detailed historical documentation, which is complemented by archaeological studies which have documented the construction methods and materials of its components, and the modifications made over more than a century of

use. This system was significant to the development of the sugar industry in Santa Isabel and the southern region of Puerto Rico during the 19th century. It possesses all the distinctive attributes of the 19th century irrigation systems, and as such it is a significant example of the construction practices of the epoch, and of how the irrigation systems were adapted according to the necessities of the industry they served. Because some parts of the system are still underground, and some are yet to be documented, it has the potential to provide additional information on this type of property. Therefore, the *Tres haciendas* irrigation system is significant under Criteria A, C and D of the National Register of Historic Places at the local and state levels. The irrigation system retains its defining features, original construction materials, structural features and its ability to convey its significance. It also holds repairs and modifications that are relevant for understanding the development through time of this type of system.

Narrative Statement of Significance (Provide at least **one** paragraph for each area of significance.)

Irrigation systems are closely linked to the development of the sugar industry in Puerto Rico since the first half of the 19th century. The construction and use of these systems were essential for the development of the sugar plantations, namely *haciendas*, in the area of the southern coastal plain. The first irrigation systems lead to a significant improvement in productivity, allowing farmers to extend cultivation to land previously considered unproductive or of average quality. Achieving also that the plantations maintained a more or less constant level of production, despite severe fluctuations in precipitation. These systems came to be so important, that in the 19th century alone, the Spanish Crown saw the need to issue tens of Acts and royal orders, to encourage their construction, as well as controlling the distribution of waters. The *Destino, Florida* and *Santa Isabel haciendas,* were the first to obtain a water concession and construct an irrigation system in the municipality of Santa Isabel. These *haciendas* were established before the municipality was created, and their owners participated in that process, many of them enjoying important positions in government. In the history of these *haciendas,* the close relationship between land tenure, sugar and local politics on the island is seen.

The relationship between irrigation systems and cultivation of sugarcane has been dutifully recognized, both by contemporary historians as authors of past centuries. For example, it is worth to begin with this quote from historian Ramón Marín de Ponce, who published in 1877:

> *[...] And if it is also true that the south area has been one of the districts where nature has shown most ungrateful, punishing their fertile fields with frequent and long droughts that have enervated their production, it is undeniable that it was the first to partially offset the lack of rain, by implementing irrigation canals on their sugarcane farms, preferred fruit to which their valleys and plains are dedicated forming the most abundant revere of its territorial wealth. Thanks to the farsighted foundation of irrigation, has managed to save a large portion of the abundant harvests in the dry years recorded in the statistics we have in view, and has this Villa placed in the forefront its commercial, urban and industrial importance, that none of the other cities of the island contest its supremacy*" [translation ours] (Marín 1877: 137-139).

For its part, in the historical summary of the irrigation system, published in the *Revista de Obras Públicas* in 1925, it says: "*In Puerto Rico land irrigation has been practiced for many years, especially in the south of the island, where, due to prolonged drought, no crop is fruitful without proper irrigation. Virtually the only crop where irrigation is used in Puerto Rico is the sugarcane*" [translation ours] (Revista de Obras Públicas 1925: 525).

Given the close relationship between sugar and irrigation systems, any discussion on the latter topic has to begin with a discussion of the sugar production in Santa Isabel, and the productive units that participated of its benefits: the *haciendas*.

The Three Haciendas

The sugar cane plantations Florida, Santa Isabel and El Destino, were the major producers of sugar in the municipality of Santa Isabel for much of the 19th century. They were producing muscovado sugar, and probably alcohol spirits, from the first quarter of that century - decades before the formation of the municipality in 1842. Their various owners, in addition to being recognized as powerful landowners, played an important role in the founding and subsequent development of the town, getting to occupy administrative positions of importance. The history of these estates illustrates the intricate relationship between the sugar industry and local politics of the 19th century.

Hacienda Florida

Hacienda Florida was established by the Valdivieso brothers, from Ponce, during the first quarter of the 19th century, when the municipality of Santa Isabel was still part of the Coamo Abajo ward of Coamo. By 1841, *La Florida* was a prosperous estate, which had thirty-nine *cuerdas* planted in sugarcane, as well as infrastructure for the production of sugar and spirits. Standing out among the structures it had were the sugar mill house, the battery house, a bagasse barn, one still, and seven huts where the eight slaves of the estate lived.

In 1844, the Valdivieso brothers sold the estate to Don José María Colón. Don Colón, who had been mayor and Trustee of Cayey, served since 1842 as the first mayor or 'settler captain' of the newly founded town of Santa Isabel (Rivera Velázquez 2010). In 1854, Don Colón sold the property to Don Nicolás Márquez, a landowner with experience in the sugar business, whom was responsible for establishing the Hacienda Isidora in Salinas, and owned another *hacienda* in Ponce. Upon the decease of Don Nicolás in 1871, *La Florida* became the property of the Nicolás Márquez Endowment. In 1876, Hacienda Florida went to Don Enrique Cabrera, who later transferred it to his brother, Carlos Cabrera.

The Cabrera family was responsible for the growth and agricultural success of the Hacienda Florida estate. The Cabreras also owned the Boca Chica *hacienda* in Ponce and planted cotton in Santa Isabel. By 1881, *La Florida* had grown considerably, with 558 *cuerdas* divided into fields, alleyways and a plaza. It also had a greater range of buildings associated with sugarcane production, some of them housing complex and costly technology. Standing out among them were a large building built in masonry comprising the engine, warehouse and *purguero*, a smaller masonry structure also functioning as a *purguero*, a 1000-gallon battery, a chimney measuring two meters at the base by 85 m tall, a tank for syrup - with its pump, an evaporator, wooden barracks for laborers, and several wooden houses for the foremen and laborers. The estate also had cutting edge machinery, as an upright steam engine with its mill and juice lifting pump, a 17 m long hammock *(hamaca)*, a fitted multitubular boiler, and three iron and copper tubing evaporators with their steam engine[3]. The irrigation channels were among the assets of the estate listed in the 1881 entry at the Land Registry:

> *"A third of the main irrigation canal corresponds to that (La Florida) Hacienda, counting from the intake to the site of water distribution between the three Haciendas ... whose journey measured hundred thirty cuerdas ... The bypass channels for partial watering are the exclusive property of*

[3] Registro de Propiedad, Santa Isabel, Tomo 1, Folios 189-193, Finca núm. 38.

> *the estate, starting from the said water distribution site"* [translation ours] (Registro de Propiedad, Santa Isabel, Tomo 1, Folios 189-193, Finca núm. 38).

Carlos Cabrera moved to San Juan soon after the US invasion of 1898, as he was selected by the governor of the island to be one of two citizens to be part of a Board which had the task of assessing all properties of Puerto Rico.


Left; view of the front and side facades of the big house on *Hacienda Florida*, now in ruins. Right; north facade of the *Hacienda Florida* factory, now used for storage by the Lands Authority.

The brown sugar produced by the *Hacienda* Florida was known to be of high quality. At a Fair Exhibition in Ponce, held in 1894, the estate won a gold medal, while the *Hacienda* Santa Isabel, won the silver. On this Agricultural Fair, the photographer Alejandro Infiesta said:

> *"Comparing the sugars presented with those exhibited some years ago, admires the transformation that is suffered amid the deep crisis affecting this sweet. It is true that P.R. production has fallen; but it also has improved in remarkable conditions by shortening time and achieving better yields. The sugars exhibited were all centrifuged, except those presented by Messrs. Cabrera and Alomar, from Santa Isabel. The sugars of this town and especially the estates of said gentlemen, although these farms do not have the vacuum pan, are white, very pleasant and of easy placement in Europe. In Barcelona they reached the gold medal, and in our opinion well deserved, because as muscovados sugars go they are unrivaled anywhere"* [translation ours] (Infiesta 1895 in Alonso 2008).

Despite the quality of its sugar, *La Florida* could not compete with the new production model of the early 20th century *centrales* or factory sugar mills. In 1902, Cabrera Paz formalized a contract with the Aguirre Sugar Company to process their sugar cane at the factory mill. In 1906, Cabrera Paz sold *La Florida* to the Aguirre Sugar Company (Rivera Velázquez 2010). In 1974, the property was transferred to the Lands Authority of the Government of Puerto Rico. In 1977, the land was leased to Mr. John Scussel, from Land Management Inc., for growing vegetables. In 1981, that company declared bankruptcy and the land returned to the Lands Authority.[4]

[4] Land Management, Inc., 14 BR 607 – Bankruptcy Court, D. Puerto Rico, 1981.

Hacienda Santa Isabel

Hacienda Santa Isabel, also known as Hacienda Alomar, was established by the Alomar Famanía-Famanía family - immigrants from Mallorca. Don Juan Famanía founded the estate, under the name of Hacienda Unión, in the first quarter of the 19th century. Upon his death in 1842, his son, Francisco Famanía, declined to take over the estate. Francisco formed part of the neighborhood board that administered the new town of Santa Isabel. The inheritance was passed on to his brother in law, Don José Alomar y Burgos, who was married to the daughter of Don Juan, Doña Gertrudis Famanía. Both lived in Mallorca and decided - together with his brother, Don Gaspar Alomar - to move to Santa Isabel in 1839 and take control of the estate. The Alomar brothers were an active part of the economic and political life of the town since their arrival (Cifre de Loubriel 1975). Gaspar Alomar participated in requesting the foundation of the town of Santa Isabel, he also served as member of the first Board of Neighbors and was mayor of Santa Isabel between 1849 and 1853.

In a report about the town of Santa Isabel, dated 1852, Hacienda Santa Isabel appears as the largest in the township, with a capital of 24,856 *pesos*[5]. Between 1855 and 1856, production was affected when the slaves became infected in a cholera epidemic. These were replaced in 1859, when Alomar bought 47 slaves from an estate in Ponce. At that time, the *hacienda* comprised 800 *cuerdas* of land - planted in sugarcane and grasses, 40 slaves, a sugar evaporator building and a kettle house (Rivera Velázquez 2008).

When it was first entered in the Land Registry, in 1882, the *hacienda* comprised 953 *cuerdas*, of which 411 were employed as cane fields and 71 were plazas and alleyways. It also had several structures among which stand out a brick-masonry structure where the batteries, clarifiers, evaporators and purifiers were located; the engine house - also built of masonry, which housed the steam mill, a machine to move the evaporators, an apparatus for sulfating the cane juice and a conveyor for the cane; two chimneys of the same build, barns for the bagasse and one wooden barrack for laborers[6].

The brown sugar produced by the *Hacienda* Santa Isabel, like that produced by the *Hacienda* Florida, was renowned for its quality. It won a gold medal at the Exhibition Fair of Ponce for the samples of brown sugar for consumption, refinement and export, and it won a silver medal at the 1894 World Fair (Rivera Velázquez 2008).

In 1902, the Alomar family leased the estate to a private investor until 1920, when they sold it to Luce and Company S. en C. The *Luce & Co*. was an agricultural society in charge of the cultivation of lands and the production of sugar cane, which belonged to the trust of the Central Aguirre Sugar Company. In 1974, the property was transferred to the Lands Authority.

[5] AGPR, Gobernadores, Caja 582, Leg. 998.

[6] Registro de Propiedad, Santa Isabel, Tomo 2, Finca núm. 69, Fls. 109-112.

Left; rear facade of the ruins of the *Hacienda* Santa Isabel. Right; front facade of the ruins of the factory building of the estate.

Hacienda El Destino

The *hacienda El Destino*, also referred to as Capó, was founded by the brothers Pedro Juan and Francisco Gil Capó Planchart. Early in the history of the estate, in 1839, the Capós owned the largest amount of land in the future jurisdiction of Santa Isabel (Rivera Velázquez 2013). In 1856, one of the brothers, Pedro Juan, was elected as mayor of the town of Ponce, where he lived. Upon the death of its last original founder, in 1870, the property was to be administered by the succession to the brothers. In the appraisal, liquidation and distribution of assets document, the *hacienda* was described in the following manner:

> *"Sugar plantation called Destino, based in the municipality of Santa Isabel, Jauca ward, with one thousand seven hundred twenty-six cuerdas, [...], with highly cultured canes, shoots and virgin forests, mangroves, coops, pastures and plazas, masonry facilities, chapel, boarding rooms, orphanage, hospital barracks and accessories, channel irrigation, wells, batteries, utensils and other equipment for the production of sugar* [translation ours] (AACUPR: Colección Aguirre, Serie Legales, Sub-serie Compra-venta, Compra-venta de la Hacienda Destino).

Of the three *haciendas*, *El Destino* was the simplest and less complex in terms of buildings and technologies associated with the production of sugar. In 1881 the estate had a sugar house constructed of masonry which housed two batteries, a chimney and three evaporators with alembic still, two wooden bagasse sheds roofed with straw, and several houses for laborers[7].

The estate remained in the hands of the Capó family, until its sale in 1920 to the Luce and Company S, en C. In 1964, 1,020 *cuerdas* of the sugar cane *hacienda* were sold to the farmer Don Pedro Ramos[8]. This was the only of the three haciendas not absorbed by the Government of Puerto Rico.

[7] Registro de Propiedad, Santa Isabel, Tomo 2, Finca núm. 49, Fls. 4-5.

[8] Archivo de Arquitectura y Construcción de la Universidad de Puerto Rico (AACUPR): Colección Aguirre, Serie Legales, Sub-serie Compra-venta, Compra-venta de la Hacienda Destino.

Ruins of structures in the *Hacienda* El Destino

From *El Guamá* to the *Tres Haciendas*

The *Tres Haciendas* were able to increase their sugar production and maintain it through the 19th century, thanks to the construction of an extensive irrigation system that carried water from the Coamo River to their land. In fact, these haciendas obtained the first waters concession on record in the municipality of Santa Isabel, and were responsible for the first irrigation system built in the jurisdiction of the town.

The Santa Isabel, Destino and Florida *Haciendas* obtained the concession to use the waters of the Coamo River for the irrigation of their fields on March 21, 1844[9]. In the record for the concession, the river is characterized as follows:

> *The Coamo river has its source in the mountain range which crosses the Island from east to west, and from its elevated part it develops and runs through a gorge between rocks some of them with very steep slopes because it has a drop of six hundred m over an area of about twenty-five kilometers, then develops on the plains of Santa Ysabel in large silty curves. Any development to be practiced must be run in places where the river slides between mountains since only there is it susceptible to such an operation, being its banks impermeable bedrock since that does not happen in the plains where the riverbed is formed from successive layers of sand and gravel which produce by filtration of much of the flow by setting subterranean causeways* (Descripción del Río Coamo. AGPR, Obras Públicas, Aguas, Leg. 21 A).

The location where Alomar, Capó and Márquez requested to build the intake of the irrigation system was known as Piedras Blancas. This place was at a considerable distance from the lands that were to be irrigated, and required large excavations, so after receiving the permission, the owners of the *haciendas* requested the intake placed instead at Guamá, located 100 *cuerdas* lower than Piedras Blancas. This was a forested area, located northwest of the three haciendas. This permit was granted on August 1, 1846, and in that same year the works were executed.[10]

The first works performed by the owners of the *Tres Haciendas* consisted of a dam, an intake for estiales (low) waters, a supply channel, a distribution module and individual channels for each of the *haciendas*. The

[9] AGPR, Fondo: Obras Públicas; Serie: Aguas; Legajo 21A.

[10] AGPR, Fondo: Obras Publicas; Serie: Aguas; Legajo 190, Caja 465.

construction works were governed by strict regulations, establishing the type and quality of materials used and the manner in which they were to be built. The irrigation project of the *Tres Haciendas*, according to the descriptions made by the representatives of the major of Santa Isabel, met all requirements of the law. The system, once built, varied over the years. Modifications responded to the growing demand for water from the haciendas, and as a result of various litigations that lasted good part of the second half of the 19th century.

The first conflict involving the owners of the *Tres Haciendas* dates from 1855, when Don Buenaventura Torres and Don Antonio Vélez, landowners from the western side of the *Río Coamo*, requested and obtained permission to use the river waters to irrigate their plantations. Don Pedro Capó and other landowners presented opposition in a rather catastrophic way:

> […] *that being in the still, peaceful possession of them* [waters of the Coamo river] *since 1846, they were threatened in 1855, a real plundering by the claim of Torres and Veles bordering the same river in the jurisdiction of Santa Isabel for the use of most of the stream of water, to what they objected because, if it be awarded, in little time would see their farms completely ruined;* […] *the river waters were barely enough for the farms which benefited: containing only five hundred cuerdas planted"* [translation ours] *(*AGPR, Obras Públicas, Agua, Legajo 21).

In this case it was agreed that the *Tres Haciendas* were to benefit of irrigation 20 days in a month and Torres and Veles the remainder. However, this concession for Torres and Veles was not executed, so the irrigation to the *Tres Haciendas* was not interrupted. As a result of this lawsuit, a Topographic Map of the lands involved, dated June 14, 1853 was produced by the surveyor Vicente García, where the planted fields, owners and structures in the area, are indicated with a code of letters and colors. The locations of existing and proposed water intakes are included in the plan, including the Piedras Blancas alternative.

In another map, dated 1863, the location of the water distribution module, the route of the channels to the *haciendas* Florida, Santa Isabel and Destino, the fields watered by each channel, and the location of the production unit of the haciendas can be seen in detail. The plan also includes a cutaway section of general or supply channel and a detail of the distribution module. As shown, the lands of the *Tres Haciendas* were concentrated to the east and northeast of the town of Santa Isabel.

Almost a decade after the lawsuit against Torres and Veles, a dispute began, lasting for several years and escalating across all colonial institutional levels up to the Spanish Supreme Court. In 1866, Don José Usera, great landowner in Coamo and Santa Isabel, proposed an ambitious project for use of the waters of the Coamo River. His project consisted of: (1) taking waters for the irrigation of 2,887 *cuerdas* he planned to plant in sugarcane, cotton and other produce; (2) the establishment of one or more water wheels to grind sugarcane and corn, process cotton and mill wood; (3) establish waterers for his cattle; and (4) lead clean waters through a pipe to supply the bathhouse. Don Useras' plan was to build a channel through which all *estial* river flow would be diverted to move the machines, and then return the water that did not correspond to him for irrigation. According to his calculations, he would be returning three-quarters of the river flow, for which the *Tres Haciendas* would not be affected.[11]

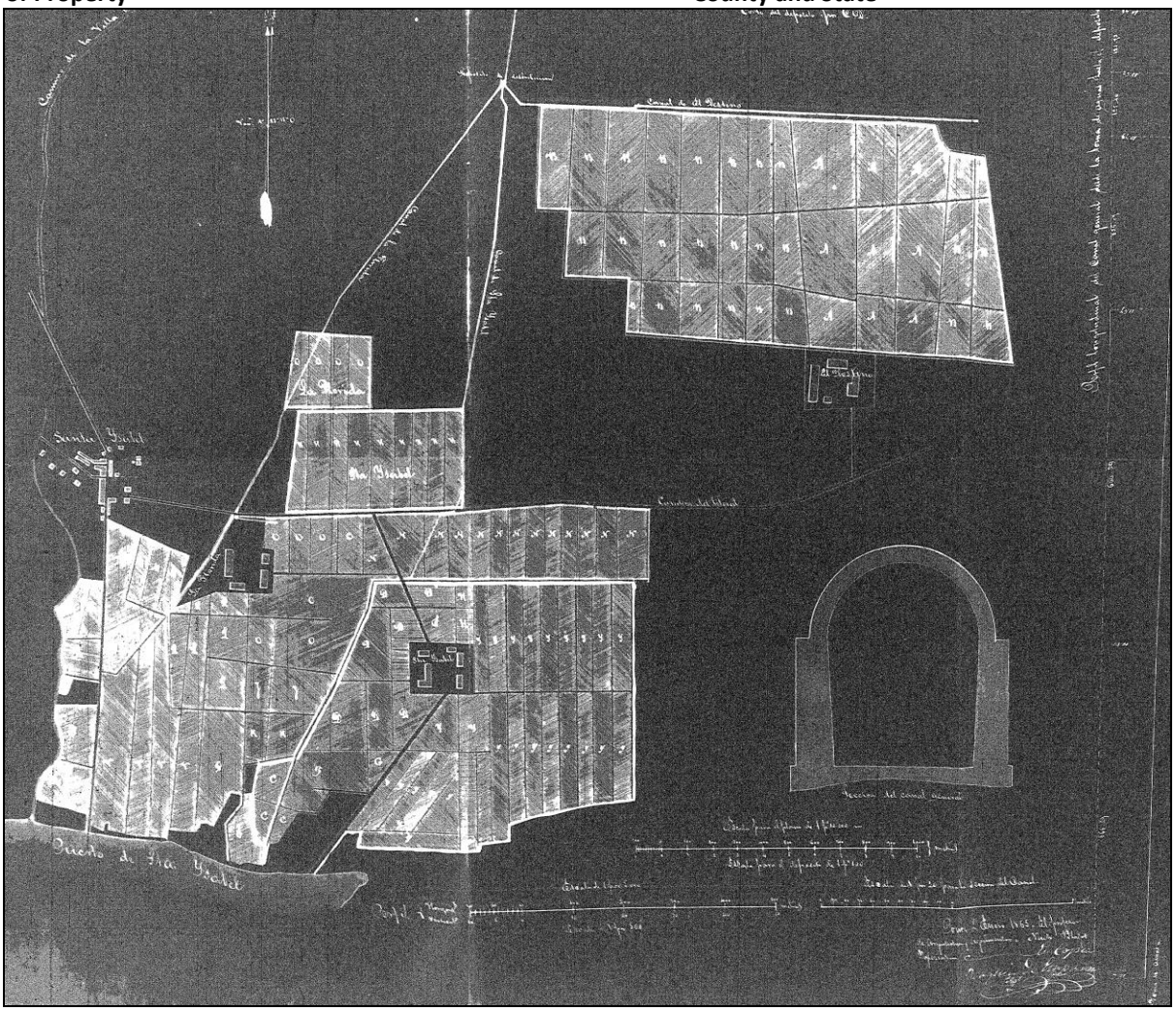
The location of the project proposed by Usera and its relation to the fields of the *Tres Haciendas* was described in a sketch of the basin of the Coamo River, made in August 1866. In it, the proposed channel is highlighted with a red line, and the existing bodies of water and the irrigation system of the *Tres Haciendas* with blue lines (Figure 11). The scale of Useras' proposed project was monumental.

[11] AGPR, Obras Públicas, Agua, Caja 410, Legajo 21.

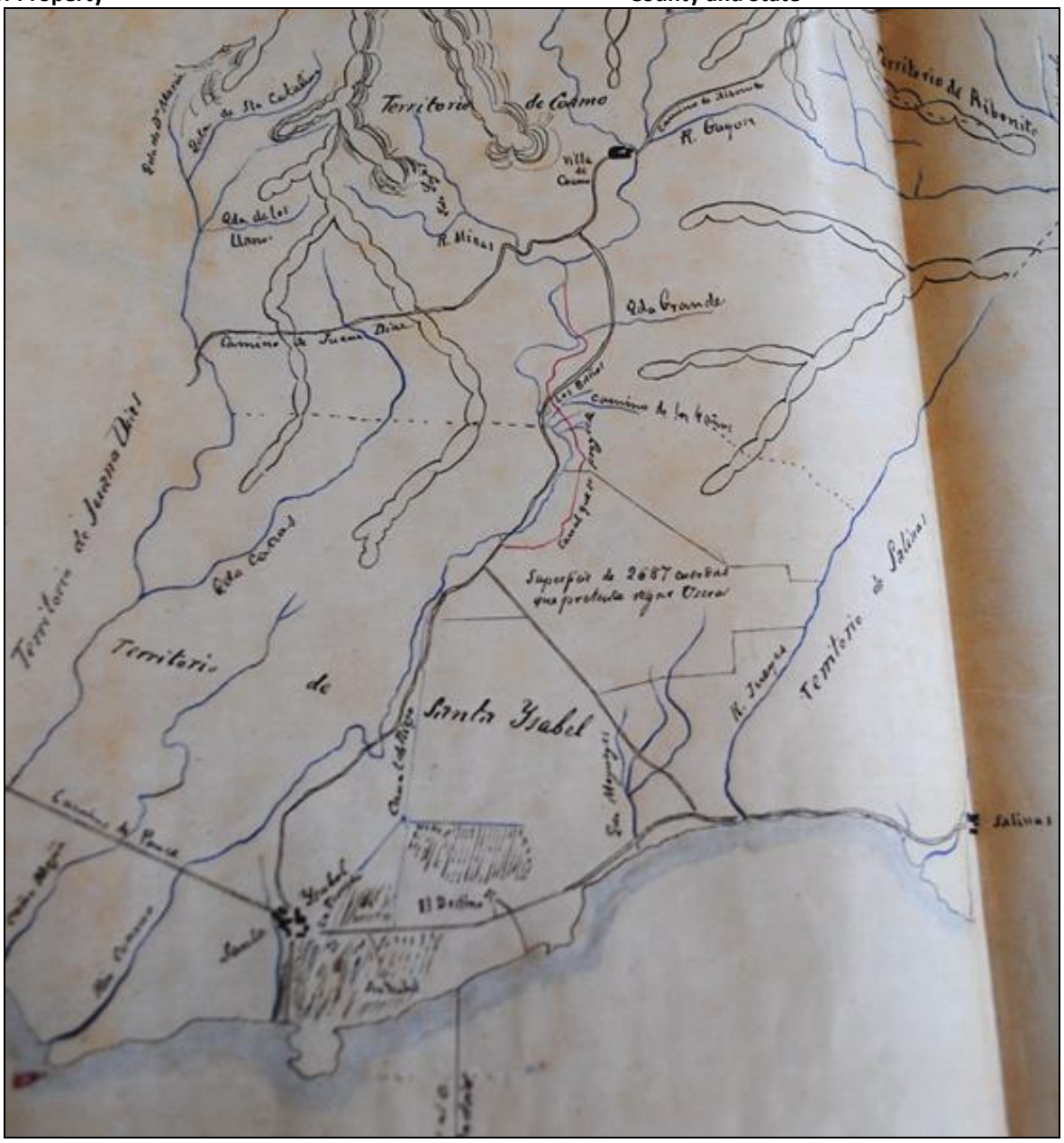
Segment of the topographic map of the lands that request and question irrigation in the jurisdiction of Sta. Ysabel to Coamo, placed according to local jurisdiction of each and belonging to Messrs. Dn. José Alomar, Dn. Pedro Juan Capó, Dn. Buenaventura Toses, neighbors from Ponce and to Dn. Antonio Vélez, neighbour of Sta. Ysabel, 1853 (AGPR, Obras Públicas, Agua, Leg. 21, Caja 410, Plano 56.2).

Sistema de riego de las tres haciendas | Santa Isabel, Puerto Rico

Name of Property | **County and State**



Map of the Destino, Florida and Santa Isabel *Haciendas*, 1865 (AHN, Ultramar, Mapas y Planos, CIH, carrete E)



Fragment of the sketch of the basin of the Coamo river, 1866. Note canal proposed by Usera in red (AGPR Serie Aguas, Legajo 21, Exp. 927).

As was to be expected, Márquez, Capó and Alomar presented opposition to Useras' project. Their opposition was based on their having a previous concession, and that it was for all the flow of the Coamo River. They argued that the water flow of the Coamo River was not enough at ordinary times to meet the needs of irrigation of their farms, and that there was therefore no surplus water to grant to Usera. In addition, they argued it would take special studies to determine the amount or exact proportions of water for irrigation. The decision in this case, issued on October 27, 1868, was unfavorable to the owners of the *Tres Haciendas*, as it granted Usera some of the Coamo River's water flow.

But the matter did not end there. The landowners filed, in January 1869, a contentious administrative suit, requesting that the sentence of October 1868 be left without effect. They argued that the decision could not be enforced unless it was demonstrated that there was a flow of excess water:

> *[…] that until the use of the waters to be enjoied are fully covered, demonstrated in the usual manner according to gauging performed in ordinary years, and taking into account the proper time of the irrigations, kind of land and crop and irrigable extent, the grant in question cannot be awarded or any other factor may be granted in accordance with Article 241* [translation ours] *(*AGPR, Obras Públicas, Agua, Caja 410, Legajo 21).

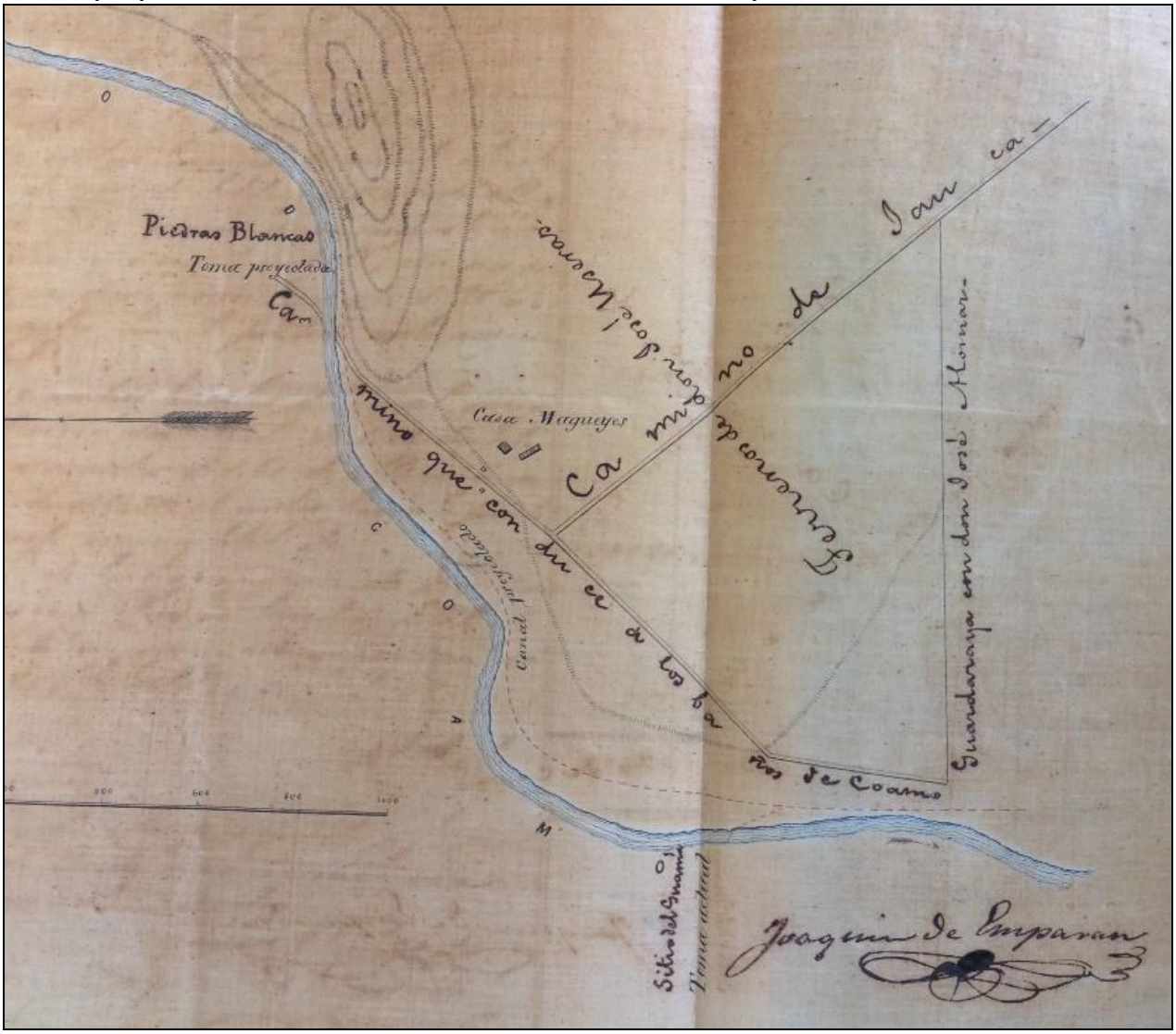
They had no objection to Usera using the winter and torrential waters not yet in use, but opposed that he be authorized the diversion of all the river water, even if it was to be later returned "*because it could cause dangers to public health, and surely cause noticeable damage to the ancient irrigators*"[12].

After both parties commissioned several studies to expert surveyors, often with contradictory results, and invested an enormous amount of resources and time, judgment was delivered in the High Court on January 18, 1873:

> *We rule and declare to José Usera entitled to take from the Coamo river a liter and 50 ounces of water per second destined to supply the bathhouse, which should lead through a pipe and placed at a fountain, […] and for the purpose of public use by the persons who attend this establishment. And set the allotment of water for irrigation of haciendas "La Florida" "Destino" and "Santa Isabel" at 324 liters per second. The government can establish the appropriate modules at the expense of their owners so that the flow is limited to the amount awarded in the previous concession; and declare, finally, that Don Jose Usera is entitled to collect the winter waters and even torrential, as they are required to complete up to 611 liters and 24 cl, and necessary precautions are taken to prevent harm and abuse by collecting them in deposits outside of the riverbed and under the conditions determined by articles third, fourth, fifth, sixth, ninth, eleventh, twelfth and thirtieth of the Provisional Government decree of October 27, 1868* [translation ours] (AGPR, Obras Públicas, Agua, Caja 410, Legajo 21).

Throughout the period in which the case between Usera and the *Tres Haciendas* carried on, the region suffered a period of drought, probably fueling the lawsuit debate and the urge to win of both parts. In testimony dated April 3, 1870, it is said that "*For a period of drought of over 2 years, interrupted only in October when it rained normally, since then no more than a light drizzle has fallen; so that in many years the mentioned river had not been seen so depleted*"[13]. The owners of the *Tres Haciendas* argued that the river waters were no longer sufficient to irrigate even a tenth of their plantations *"Anticipating the consequent ruin for lack of this life-giving element"*[14]. In view of this they requested to extend the supply channel upstream, to the point of Piedras Blancas, where they had been granted the intake originally. There is no evidence in the historical record nor in the archaeological record that this project was completed.

[12] AGPR, Obras Públicas, Agua, Caja 410, Legajo 21.
[13] AGPR, Obras Públicas, Agua, Caja 410, Legajo 21.
[14] AGPR, Obras Públicas, Agua, Caja 410, Legajo 21, Exp. 516.



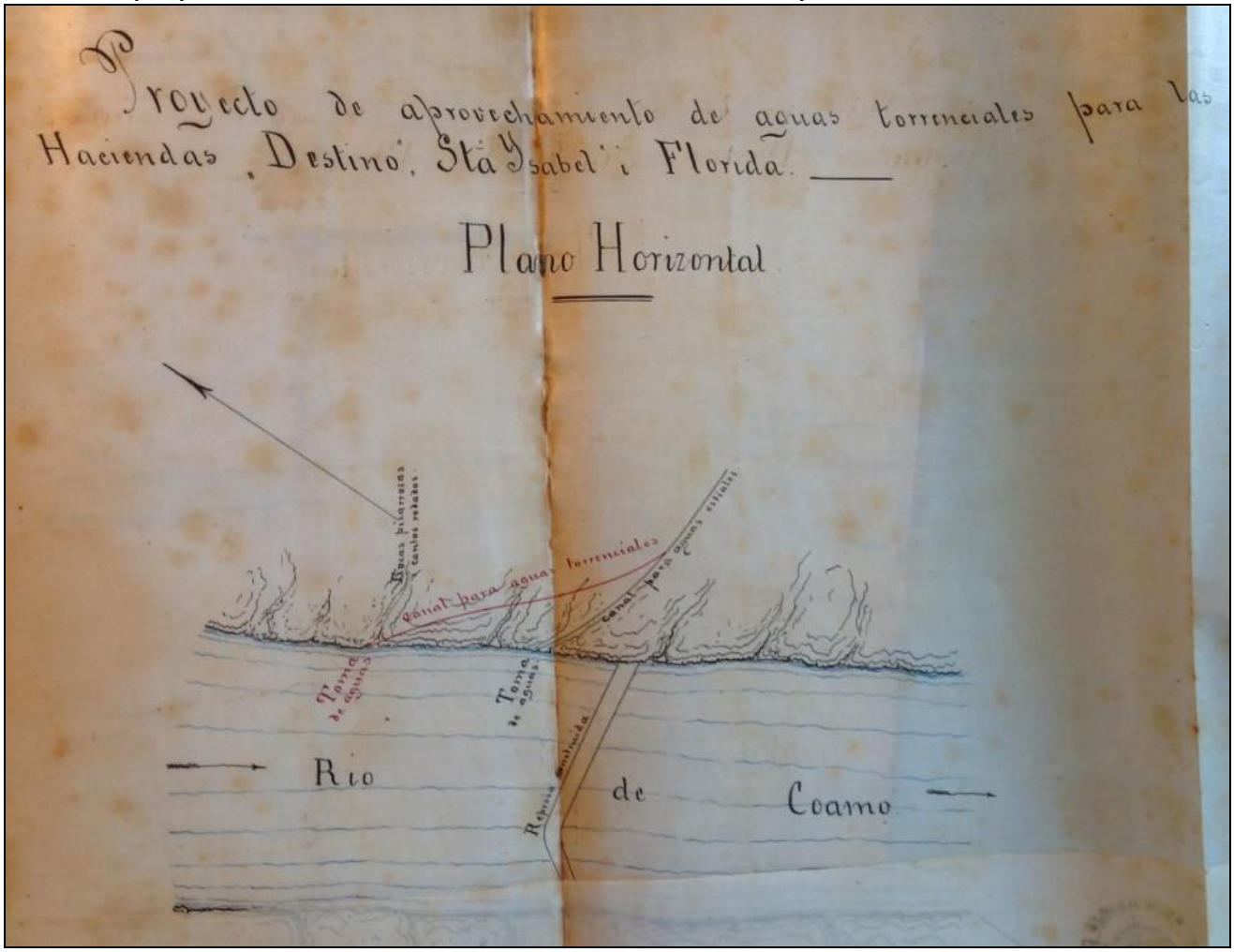
Plan for the supply channel extension to a new intake at Piedras Blancas (AGPR, Obras Públicas, Agua, Legajo 21, Exp. 516)

The module for harnessing 324 liters of water per second, corresponding to the *Tres Haciendas* - Florida, Destino and Santa Isabel- for watering their fields, was approved by Royal Order of March 28, 1875. It was built in compliance with all rules set forth in the Act on irrigation and within the time period stated in the permit. Because of the construction of this new structure, the owners of the *Tres Haciendas* requested a waiver to expropriate land adjacent to the river, according to them considering that:

> *This channel for storm water runs a distance of twenty meters along the same Coamo river and joins the low water channel, through land of low value and because the vault runs underground the damage that could be caused would be provisional and inconsiderable, the owner does not ask any compensation for the occupation of the land"* (AGPR, Obras Públicas, Aguas, Legajo 21, exp. 112).

In 1883, the *Tres Haciendas* got approval for the use of the torrential waters. This water inlet was to be located upstream of the dam and the low *estiales* water intake. The project was approved by the authorities in March 1884.

Sistema de riego de las tres haciendas | Santa Isabel, Puerto Rico
Name of Property | **County and State**



Horizontal plan of the Project for collecting torrential waters for the Destino, Santa Ysabel and Florida *Haciendas*, 1882 (AGPR, Obras Públicas, Leg. 21)

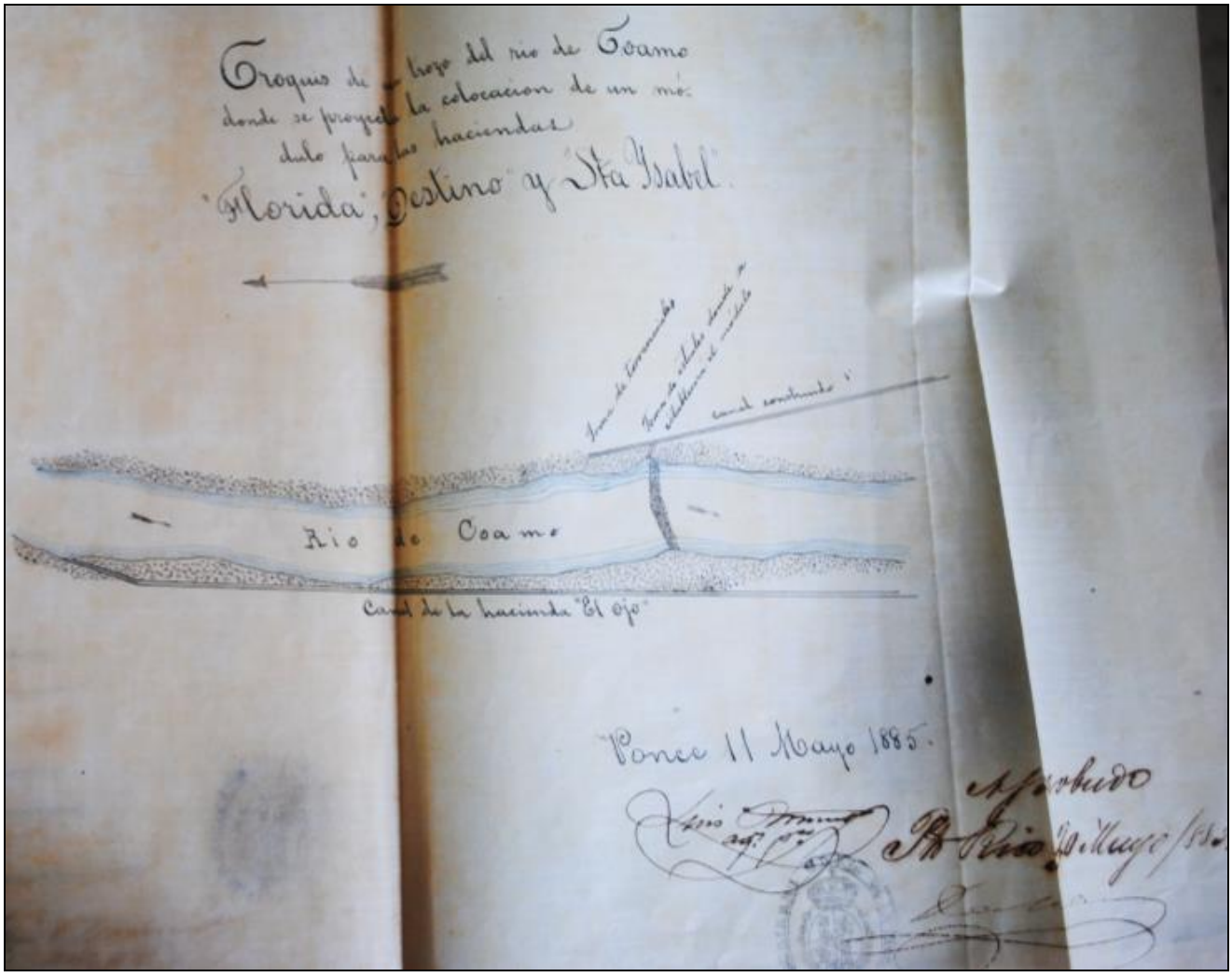
On March 19, 1886, Don Gaspar Alomar, Don Carlos Cabrera, and Don Francisco del Arce requested an extension of irrigations for their *haciendas*. They wanted to derive the seasonal water by a volume of 200 liters per second. According to the project file, the *Tres Haciendas* used winter, spring and torrential waters at a rate of 324 liters per second to water 414,40 hectares of land. According to the request for extension of irrigations, the grounds of the *Tres Haciendas* had 1.474,2554 hectares, of which 1.059,8854 were not being irrigated at the time, and "*at a rate of 78 centiliters per hectare and secondly that the site adopted in this river would require 326,6872 liters per second*"[15]. In order to justify their application more forcefully, the petitioners declared:

> *And when so, the river is left to run loose and a large volume of water, which is capable of producing great benefits, is wastefully lost into the sea: the volume corresponding to a layer of roughly 10 centimeters, measured from the low water level; because among the clauses of the concession granted to these haciendas for the use of winter, summer and torrential waters there*

[15] AGPR, Obras Públicas, Aguas, Caja 410, Legajo 21, Exp. 111. 1885-1886.

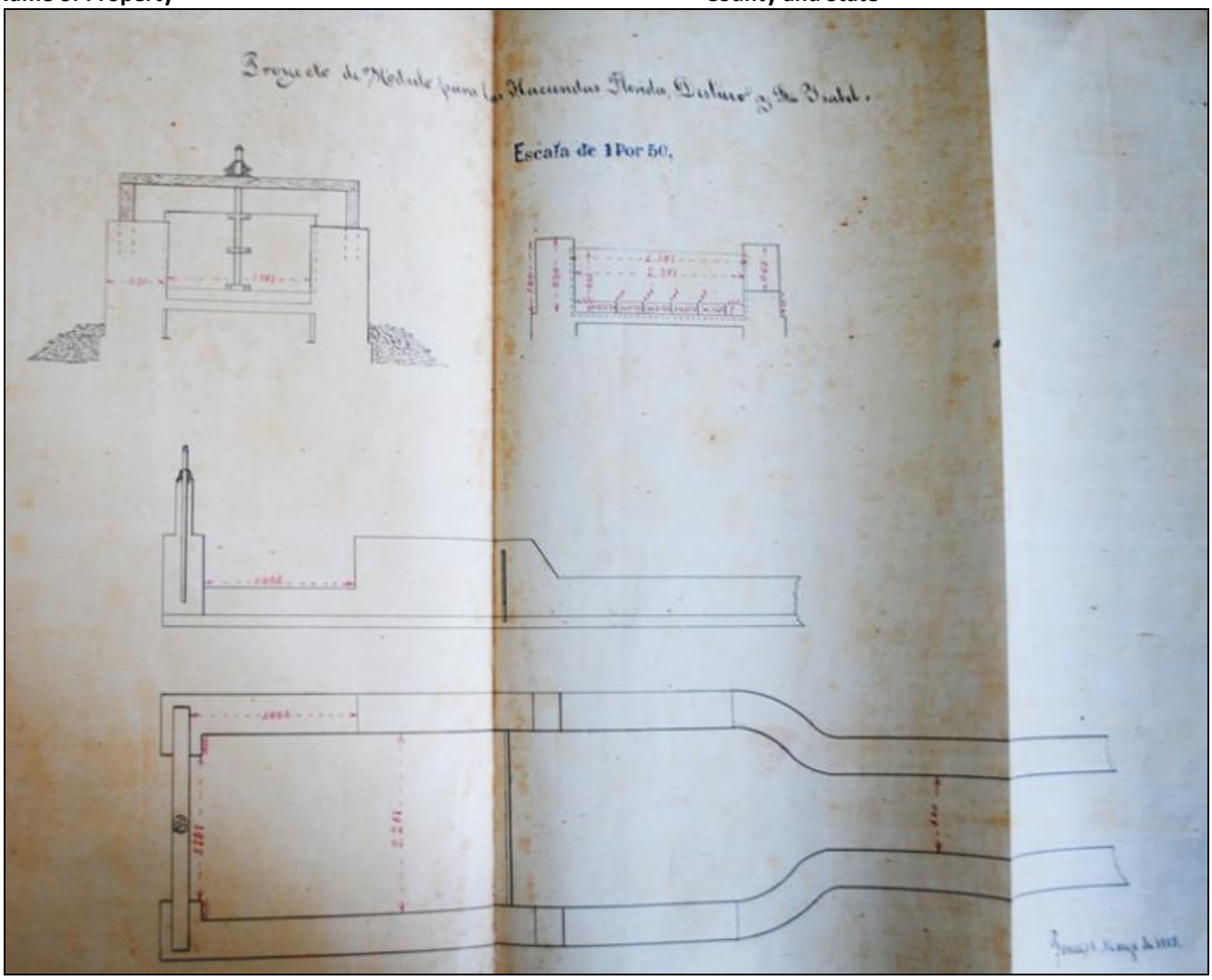
is one which requires that the floor of the intake be placed ten centimeters above that level [translation ours] (AGPR, Obras Públicas, Aguas, Legajo 21, Exp. 111. 1885-1886).

On July 30, 1886, the Public Works Headquarters (*Jefatura de Obras Públicas*) issued the authorization for the works proposed by the co-owners of the *haciendas* Santa Isabel, Florida and Destino to be constructed. The proposed module was designed by engineer Don Manuel Maese especially for this project, distinguishing it from the prevailing model for: "*having the threshold at the mouth of the inlet 35 centimeters higher than the floor of the basin, having the hydrometric gate to be the same width as the mouth, and placing the spillway further inside*".[16] In addition, the new module would be five centimeters higher than the slab of the already "*primitive*" module.



Sketch of a segment of the Coamo river with the placement of a module for the *haciendas* Florida, Destino and Santa Ysabel, May 11, 1885 (AGPR, Obras Públicas, Aguas, Caja 410, Leg. 21, Exp. 849).

[16] AGPR, Obras Públicas, Aguas, Caja 410, Legajo 21, Exp. 111. 1885-1886.



Projected water module for *Haciendas* Florida, Destino and Santa Ysabel, 1885 (AGPR, Obras Públicas, Aguas, Caja 410, Leg. 21, Exp. 849).

Shortly thereafter, the Headquarters of Public Works authorized Don Gaspar Alomar, Don Carlos Cabrera and Don Francisco de Arce to perform a new change, rare or even unique in its class. This consisted of the division in two of the intakes for winter (low), spring and storm waters. The authorization specified that one of the taps would be modulated to feed 200 liters per second of winter and spring waters to the Santa Isabel, Florida and Destino *haciendas*, while the other water inlet be channeled exclusively the torrential waters. It also notes that the new intake for winter and spring waters would be based on the plans proposed in the draft submitted to the headquarters. Furthermore, any modification would have required the express permission of the General Government. As for the storm waters intake, it was indicated that it may use the already existing one provided the threshold of the floor be raised so that it stood 15 centimeters higher than the average low water level of the river. Likewise, the Headquarters of Public Works established that there was a period of fifteen days to notify of the resolution to the petitioners. They had to pay 2 pesos with 58 cents, 1% of the budget of the works, as a guarantee that it would comply with the conditions of the new concession. Finally, the construction was to begin within thirty days and couldn't begin until "*officially received and recognized*". On December 16, 1886, the

landowners requested: "*an extension from that term for one month, in order to begin those works at a better time when the river courses flow rate would not destroy the works to be executed*".[17]

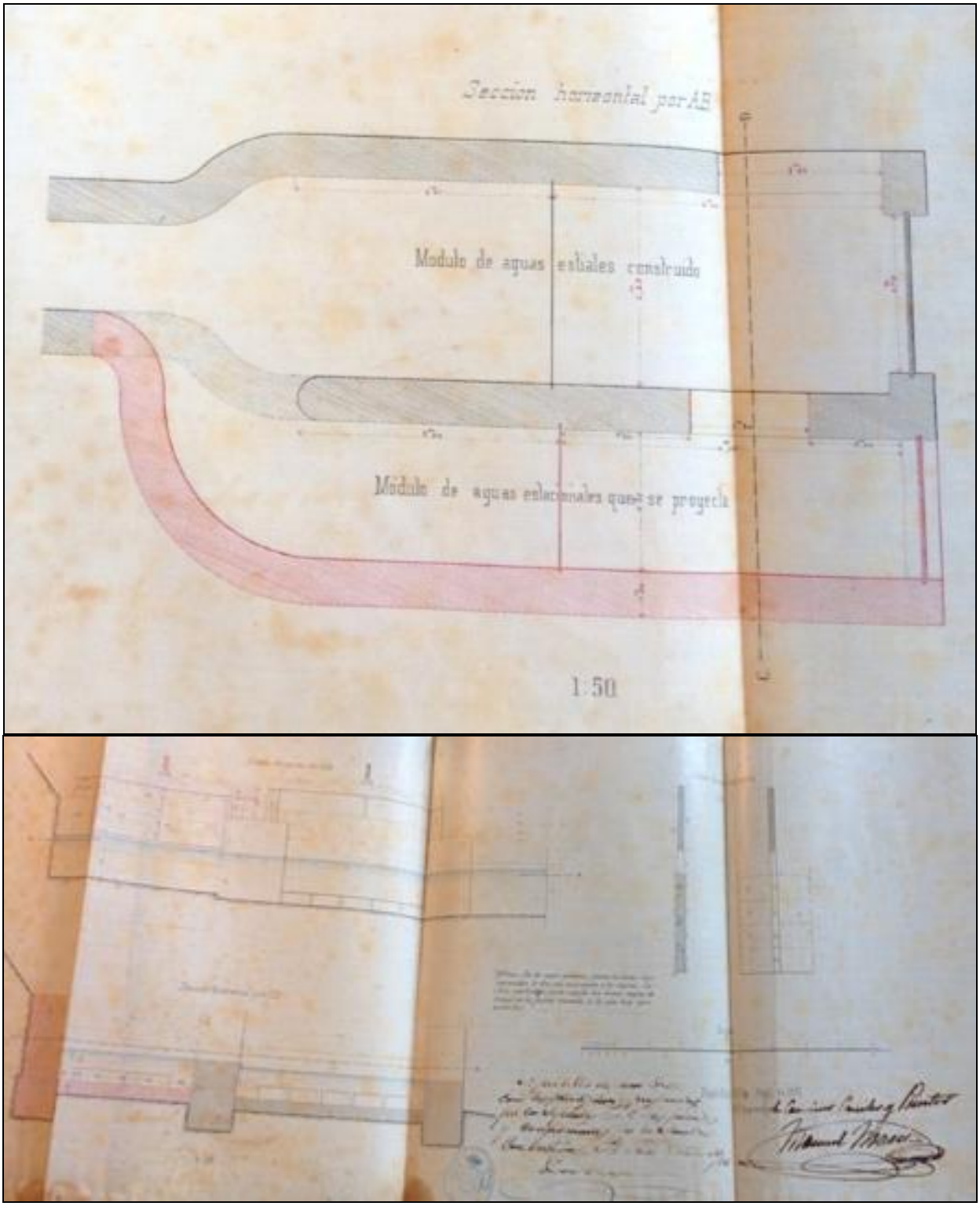
The materials for the new work of the *Tres Haciendas*, according to the corresponding file, included: hard stone extracted from quarry for masonry, boulders extracted from the river for foundations, hard quarry stone, crushed for concrete, regular locally produced lime, locally sourced hydraulic lime, weighed foundation stone of good plastic quality, powdered brick, washed and sifted river sand, hard river gravel, washed and crushed for concrete, regular sized masonry brick of 0,25 x 0,12 x 0, 05, large masonry brick of 0,30 m x 0,15 x 0,055, and mild wrought iron forged into bolts and bars.[18]

The structure was received and approved in 1887. The works on the module were the last made to the *Tres Haciendas* irrigation system. The last decade of the 19th century saw a general sugar crisis which led hundreds of haciendas to ruin. The three haciendas tried to stay afloat, but they did not succeed. In the next two decades their lands would be purchased or leased by the conglomerate of the Central Aguirre. However, the irrigation system would continue in use, and at a greater capacity than before.

[17] AGPR, Obras Públicas, Aguas, Legajo 21, Exp. 111. 1885-1886, Caja 410.

[18] AGPR, Obras Públicas, Aguas, Legajo 21 A, Exp. 785, Caja 411.

Sistema de riego de las tres haciendas | Santa Isabel, Puerto Rico
Name of Property | **County and State**



Project for a module for the collection of 200 liters per second for the irrigation of the Florida, Destino and Santa Isabel *haciendas* (AGPR, Obras Públicas, Aguas, Leg. 21, Exp. 849, Caja 410).

With the emergence of the Irrigation District of the South Coast, the system of the *Tres Haciendas* continued functioning, now within the district in the section of the Juana Díaz channel, which passes through the north of Santa Isabel. Although the nineteenth century channels were privately owned with water concessions from the Spanish period, landowners had to give up their rights to the government as part of the agreements for the eventual construction of the new irrigation channels. The Irrigation District was to provide maintenance services and in some cases expand irrigated areas. Once integrated into the new district, the various components of the system were repaired with the same materials in which the new system was built. However, the first intervention recorded in the channels was conducted between 1904 and 1910 by the Ponce & Guayama Railroad, when bridges and overpasses over sections of the channels were repaired and built, as observed at the Channel of *Hacienda* El Destino. Between 1910 and 1914, now serving as part of the new Irrigation District, existing channels are evaluated and repaired and the reservoir at the Coamo River is built. Between 1942 and 1947, upon the creation of the Water Resources Authority (*Autoridad de Fuentes Fluviales*) thanks to Law number 83 from May 2, a second supervision was conducted, as well as improvements to the system (García y López 2011: 51-52).

Photo of the main intake for the Florida, Santa Isabel and Destino *Haciendas* or *Tres Haciendas* at the junction of the main canal and the Coamo river, 1913, AAA (from Meléndez Maíz 2011).

The irrigation channels of the system of the *Tres Haciendas*, as well as more recent branches, deteriorated considerably after their abandonment between the 1980's and 1990's. Some new tenants of the properties served by this system no longer had use for it, so the channels became nuisances to their agricultural activities, so much that some segments were partially buried or even intentionally destroyed. In contrast, landowners in urban areas protect, care for and give maintenance to the channels with the expectation of seeing them working again.

According to the historical documentation, during the 19th century several tens of concessions were granted to build irrigation systems from different rivers of the southern coastal plain. Despite the importance of these systems to the agricultural development on the island, few have been studied archaeologically. For since they

were abandoned, most of these structures are in dilapidated state or hidden under layers of earth, thus entering the realm of archaeological research.

So far, the only nineteenth century irrigation system that has been documented as a whole is the *Tres Haciendas*. This system offers the unique opportunity to traverse from its dam in the river to where each of the channels that compose it ends, observing along its route the various engineering solutions employed to fit the topography of the area, and the modifications it suffered over more than a century of continuous use. In this sense, the irrigation system of the *Tres Haciendas* is unique in its class.

According to the *Revista de Obras Públicas* (1925: 525), a journal of the engineering professional community from the early 20th century, all irrigation works made before the US occupation consisted simply of private diversions of water from the rivers. However, as the *Tres Haciendas* system shows, rather than simple, they were an ingenious product of human need to meet the conditions of their environment, using simple local materials, but supported on a complex system of laws, regulations, and social interactions.

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Sistema de riego de las tres haciendas | Santa Isabel, Puerto Rico
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2010 http://www.santaisabelpr.com/conflicto-entre-hacendados-por-uso-de-aguas-del-rio

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Previous documentation on file (NPS):
___ preliminary determination of individual listing (36 CFR 67 has been requested)
___ previously listed in the National Register
___ previously determined eligible by the National Register
___ designated a National Historic Landmark
___ recorded by Historic American Buildings Survey #
___ recorded by Historic American Engineering Record #
___ recorded by Historic American Landscape Survey #

Primary location of additional data:
_X_ State Historic Preservation Office
___ Other State agency
___ Federal agency
___ Local government
___ University
_X_ Other (Name of repository)
General Archive of Puerto Rico

Historic Resources Survey Number (if assigned): _____

10. Geographical Data

Acreage of property 9 acres | USGS Quadrangle Santa Isabel & Coamo

UTM References

Datum (indicated on USGS map): Datum is mean sea level

_X_ NAD 1927 or ___ NAD 1983

	Zone	Easting	Northing
1.	19Q	776294.46	1993467.44
2.	19Q	776484.41	1989882.98
3.	19Q	777729.01	1989785.02
4.	19Q	776319.04	1988604.14
5.	19Q	776025.22	1988596.80
6.	19Q	776005.21	1989410.42

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7.	Zone	19Q	Easting	775402.70	Northing	1988206.09
8.	Zone	19Q	Easting	775928.25	Northing	1988188.31
9.	Zone	19Q	Easting	775789.71	Northing	1989276.93
10.	Zone	19Q	Easting	776234.06	Northing	1989280.41

Figure 1: Latitude/Longitude Points of Reference over Aerial Photograph

Verbal Boundary Description (Describe the boundaries of the property.)

The *Tres Haciendas* Irrigation System District is a linear resource that extends for several kilometers. It is located within the following boundaries: to the North, PR-52, to the East, PR-153 and agricultural fields; to the South, agricultural fields, PR-1 and Santa Isabel urban core; and to the West, the Coamo River, El Ojo community, agricultural fields, PR-153 and Santa Isabel urban core. Refer to Figures 21 and 22 for precise location.

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Boundary Justification (Explain why the boundaries were selected.)

The boundary corresponds to the area where the physical components of the district are located with a 3 m-wide easement.

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Figure 2: Location of *Tres Haciendas* Irrigation System in 2016 Aerial Photo (GoogleEarth)

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Figure 3: Location of *Tres Haciendas* Irrigation System in USGS 7.5´ Topograhic Quadrangles

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11. Form Prepared By

name/title Sharon Meléndez Ortiz
organization | date 11 August 2016
street & number Villas de Caney J-3 Mabo | telephone 787-485-9459
city or town Trujillo Alto | state PR | zip code 00976
email smelendezortiz@hotmail.com

Photo Log

[Refer to Figures 21 & 22 for photographs key]

Name of Property **Sistema de riego de las tres haciendas**

City or Vicinity Santa Isabel | County Santa Isabel | State Puerto Rico

Photographer Sharon Meléndez, Samuel Figueroa, Vanessa Rivera (All but photograph 033. See below.) | Date Photographed 16 June 2016

1. General view of the dam area on the Coamo river; looking northwest; 0001
2. General view of the water modules and dam on the Coamo river; looking west; 0002
3. Partial view of the dam on the Coamo river; looking northwest; 0003
4. Detail view of the dam fabric; looking north; 0004
5. General view of supply channel, water modules and dam on the Coamo river; looking north, 0005
6. Partial view of low and seasonal water modules; looking north; 0006
7. Partial view of low waters module and storm water intake; looking northeast; 0007
8. General view of waters module easternmost masonry wall, and storm water intake; looking north; 0008
9. General view of low and seasonal waters module; looking southwest; 0009
10. Partial view of the storm water intake; looking south; 0010
11. View of the northern limit of the easternmost masonry wall; looking south; 0011
12. General view of rounded-crown masonry wall on the east bank of the Coamo river; looking west; 0012
13. Broken section of the storm waters intake, looking north; 0013
14. Arched entrance to the supply channel from the storm water intake, looking west; 0014
15. Partial view of the module and storm waters intake construction materials; looking east; 0015
16. Detail view of the entrance of the supply channel from the seasonal waters module; looking south; 0016
17. View of the dam and water modules on the Coamo river; looking northeast, 017. In the background, the highway bridge; 0017
18. Detail view of the storm waters intake interior; looking north; 0018
19. Detail view of the supply channel exterior, on the eastern bank of Coamo river; looking southwest; 0019
20. Supply channel manhole in front of residence at La Olla Community; looking northeast; 0020
21. Supply channel manhole in front of a vacant yard at La Olla Community; looking west; 0021
22. Detail of supply channel manhole shaft, at La Olla Community; looking down; 0022
23. Eroded supply channel manhole at a residence's backyard; looking northwest; 0023
24. Supply channel as it emerges to surface level, La Olla Community; looking southeast; 0024

25. Open segment of the supply channel in a backyard, partially filled with dirt; La Olla Community; looking south; 0025
26. Point at which supply channel reemerges from crossing under road PR-156, now filled with dirt; looking south form east side of PR-156; 0026
27. New branch and sluice gates added to the supply channel by the Irrigation District of the South Coast. The left channel supplied water to a 20th century retention pond; looking south; 0027
28. Detail of open segment of supply channel, with portions filled with dirt, covered by metal plank and under houses; looking south; 0028
29. View of supply channel route buried under dirt mounds; looking southeast; 0029
30. Open segment of supply channel, partially filled with dirt and covered by grass; looking north; 0030
31. Distribution module site; looking northeast; 0031
32. Detail of sluice gate at southern bend of Santa Isabel channel; looking southeast; 0032
33. Left, Detail of Santa Isabel channel interior wall; looking northeast. Right, Open raised section of Santa Isabel channel over arch; looking north; 0033. Photographer: Marisol Meléndez Maíz; 2011.
34. View of Destino channel route, covered by vegetation; looking east; 0034
35. Detail view of Destino channel segment; looking north; 0035
36. Detail view of Florida channel segment, covered by vegetation; looking southeast; 0036
37. Detail of wall exterior of Florida channel; looking west; 0037
38. View of joint between masonry segment and newer concrete repair of Florida channel; looking northeast; 0038
39. General view of Florida channel branch (channel 5), partially filled with dirt and vegetation; looking west; 0039
40. Detail of sluice gate in Florida channel branch (channel 5); looking north; 0040
41. Remnant of Florida channel in vacant lot north of urban core; looking south; 0041
42. Segment of Florida channel roofed with concrete, crossing Santa Isabel's urban core; looking south; 0042
43. Segment of Florida channel parallel to and south of PR-2; looking west; 0043
44. General view of final open segment of Florida channel; looking east; 0044
45. General view of final open segment of Florida channel; looking southwest; 0045
46. End of Florida channel; looking west; 0046
47. Detail view of Florida channel construction method and materials; looking northwest; 0047
48. View of supply channel route buried under dirt mounds and vegetation; looking south; 0048

Sistema de riego de las tres haciendas | Santa Isabel, Puerto Rico

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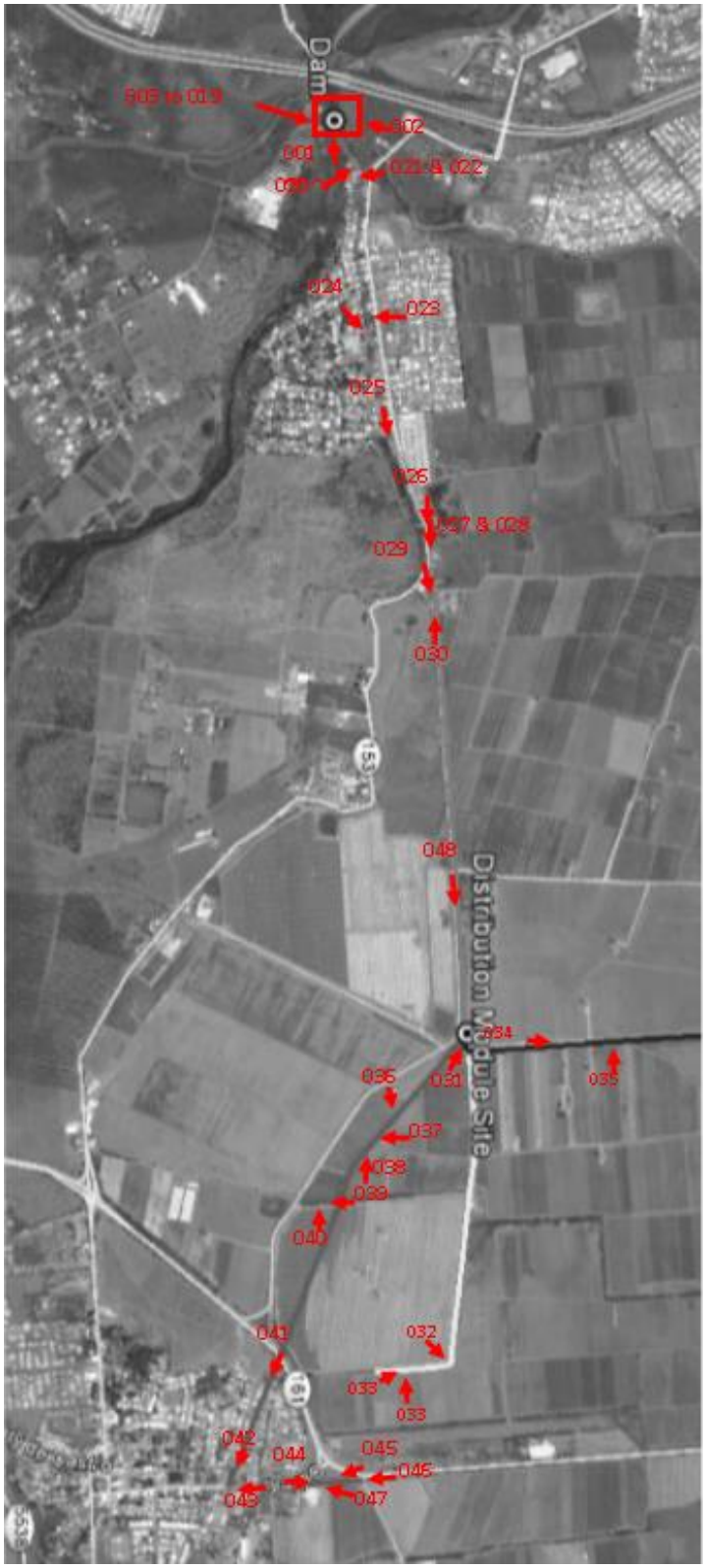

Figure 22: Aerial photograph with photo locations

Sistema de riego de las tres haciendas | Santa Isabel, Puerto Rico

Name of Property | **County and State**

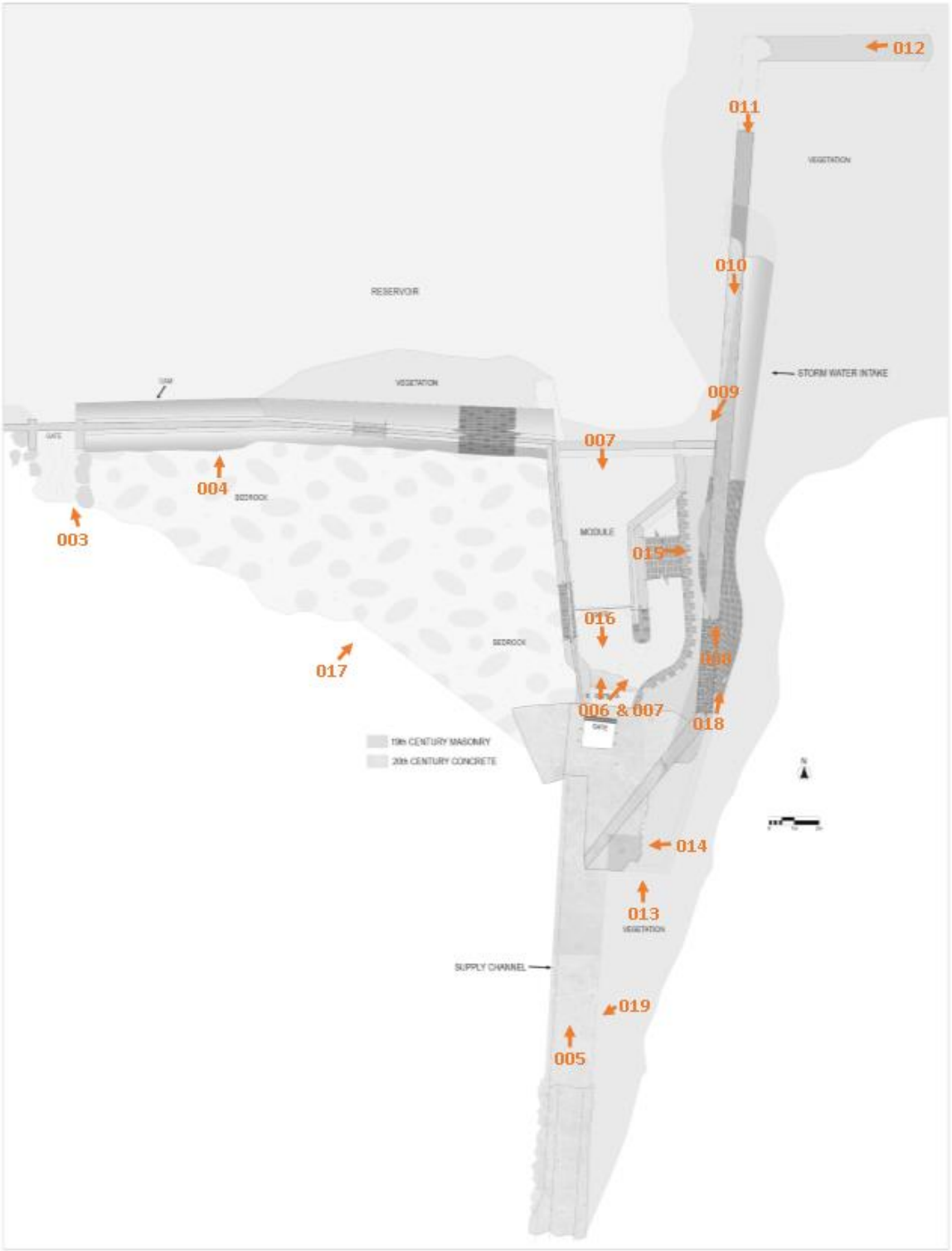

Figure 23: Drawing of dam and module areas with photo locations