DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS, ANTILLES OFFICE
400 FERNANDEZ JUNCOS AVENUE
SAN JUAN, PUERTO RICO 00901-3299

REPLY TO ATTENTION OF: OEC -4

Antilles Regulatory Section
199905598(1P-ML)

Mr. Ovidio Garcia-Amador
PO Box 340
Mayaguez, PR 00681-0340

Dear Mr. Garcia-Amaaor:

Reference is made to the Department of the Army permit application submitted for the discharge of fill material into waters of the United States at tributaries to Boquilla Creek, for the development of Elite Valley Town Center project. The project is located at PR-2, Km. 179, intersection with PR-64, El Mani Sector, Sabanetas Ward, MayagOez, Puerto Rico. Please refer to number 199905598(IP-ML) in future correspondence regarding this project.

On November 20, 2002, we met with a property owner whose property adjoins your project across PR-2. He argued that he was not aware on the proposed project and requested to meet with the Corps to express his concerns. A revision of the information at the file confirmed that you provided mailing addresses for adjoining property owners across PR-2, except for him.

The property owner is concerned on the effect of the hydrological modifications proposed for the Elite Valley project on his property. The Boquilla Creek (channel B-B), which you propose to fill and relocate in boxculvert A-A and open channel G-G, limits his property across PR-2. He is of the opinion that the proposed structure to relocate the Creek is not Lonc ennt lah and would not provide enough slope to maintain the flow of the water downstream, in a west, north-west direction. He states that since the water table is high in the area an inadequate slope would promote that the water remains stagnant, or even may produce a backflow, affecting his property. He suggested that a boxculvert be placed on the current location of the Boquilla Creek (channel B-B), and be extended to discharge directly underneath PR-64. He opines that this would provide the adequate slope to drain the waters coming from the Creek underneath PR-2.

He also expressed concerns on the conditions of the bridge at the north-west corner of your property, where channel D-D drains underneath PR-64. He states that the improvements proposed for channel D-D, are useless to improve drainage downstream, since this bridge would not be capable of adequately drainage the water load,

The property owner also stated that the U.S. Department of Agriculture study of 1964, cited in the Public Notice as similar to the current proposal, was made to maintain the agricultural lands. Therefore, should not be used as reference to manage the hydrology in the area, since land use is different than agriculture, the surrounding properties has been developed, and the hydrology modified.

The hydrological / hydraulic study (H-H) you submitted on November 29, 2001, had the purpose to manage the stormwater runoff caused by the Ellite Valley construction project. It intended to provide measures to keep the new maximum flows equal or less than the existing ones. The H-H describes two drainage problems at the site: 1) sedimentation of channel D-D and the culvert underneath PR-64, and 2) low movement, almost stagnation, of waters draining to the Cali() Boquilla, north to the proposed project site. The H-H identified waters draining though the boquiiia Creek, east io PR-2 as oi of the water sources to the proposed Elite Valley site. The Boquilla Creek reaches the site through a 3m x 3m box culvert underneath PR-2. Drainage of waters through the boxculverts at PR-2 would depend on the level of waters at the Boquilla Creek within the project site. According to the H-H elevation of the Creek at the boxculvert to the east of PR-2 is 5.5 meters, while at the project site is of 4.5 meters. The elevation of the proposed channel A-A at the discharge point is proposed at 3.5 meters.

As alternative to manage waters at the Boquilla Creek the H-H proposes to elongate the existing boxculvert along 122 meters (channel A-A) in an orientation similar to the existing boxculevrt (east-west orientation). The H-H states that the existing culvert at PR-2 does not have the capacity to transport the Q_{100} for the watershed. The proposed culvert elongation and dimensions would provide for such. The H-H also recommends to widen and concrete-cover channel D-D by constructing a 10 meters wide trapezoidal channel. Expectations based on the H-H are that with the construction of the Elite Valley project waters would drain faster than in the current conditions.

The H-H does not provide detail on potential water stagnation or backflow. Therefore, we need to confirm or clarify the following:

1) That the proposed channel A-A and G-G has the appropriate length and slope to maintain water flowing downstream. Certify that the water would not remain stagnant, or that backflow would not be produced at the channel.

2) That the proposed channel D-D provides the appropriate slope such that waters flowing through channel A-A and G-G would effectively drain, and would not remain stagnant or cause a backflow.

3) Please explain any effects of the high water table in restricting water drainage downstream the earth-gabion-bottom channels.

4) Evaluate the alternative to place the proposed boxculvert A-A in the current location of the Boquilla Creek (north-west orientation), and elongate it to the discharge point underneath PR-64. Discuss if this alternative would provide better slopes, such that the water does not remain stagnant, or backflow is caused.

5) Clarify how do you propose to join the proposed culvert A-A, which is 8 meters wide, with the existing underneath PR-2, which is 6 meters wide.

6) Clarify if you propose improvements to the culvert underneath PR-64, which is the discharge point of the proposed channels. If not, explain how would you manage water flows at the channels if this point is clugged. Is the capacity of the culvert underneath PR-64 compatible with the proposed dimensions of channel D-D? Would the cuiveri have the hydroiogicai capacity to manage the water loads flowing thrOugh the new channels?

7) It is our understanding that you should have obtained a WQC by now. If not please provide the related information for us to determine if a waiver has occurred.

The above-requested information must be provided for us to complete the public interest review. Any other information you feel may be helpful in order to fully justify the proposal should also be submitted. Please make sure to clearly and specifically answer each item listed in this letter. This would expedite the evaluation of your response.

Your application will be held in abeyance for 30 days pending receipt of your response. If you wish to modify the application taking into account the guidelines and our comments as explained, and need more than 30 days to do so, you may request a reasonable additional time extension. If within the next 30 days from the date of this letter we do not received a written communication from you we will take final action on your Department of the Army permit application. Final action could include deactivation of your permit application. Should the file be withdraw it will be retained for a period of one year.

You are cautioned that any work performed below the mean high waterline or ordinary high waterline in waters of the United States, or the discharge of dredged or fill material into adjacent wetlands, without a Department of the Army permit could subject to enforcement action. Receipt of a permit or endorsement from other agency does not obviate the requirement for obtaining a Department of the Army permit for the work described above prior to commencing work.

If you have any questions contact Ms. Myrna Lopez, at telephones 729-6905/6944, extension 3059, or at the letterhead address.

Sincerely,

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dwin E. ni
Chief, Antilles Regulatory Section

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P.O. Box 340, Mayagtlez, Puerto Rico 00681-0340 Tel: (787) 254-3957

January 3,2003

Mr. Edwin E. Mufiiz
Chief Antilles Regulatory Section
U.S. Army Corps of Engineers
400 Fernandez Juncos Avenue
San Juan, Puerto Rico 00901-3299

Re: Strong Criteria for Final Approval of Permit Application No. 199905598 (IP-ML), Joint Permit Application No.212.

Dear Mr.

This is in response to letter sent by youon December 4, 2002, where Miss Myrna Lopez states that on November 20, 2002, she met with an apparently property owner who argued that his property adjoins our project East across PR-2 within the 100 meters diameter distance and that a revision of the information at the Corps File confirmed that we provided mailing addresses for adjoining property owners across PR-2, except for him. At present and on June 25, 2001, when we submitted the referred Joint Permit Application, the real owner was and is, Cesani Hardware, Inc. according to GRIM Records and Map Number 207, both included as evidence.

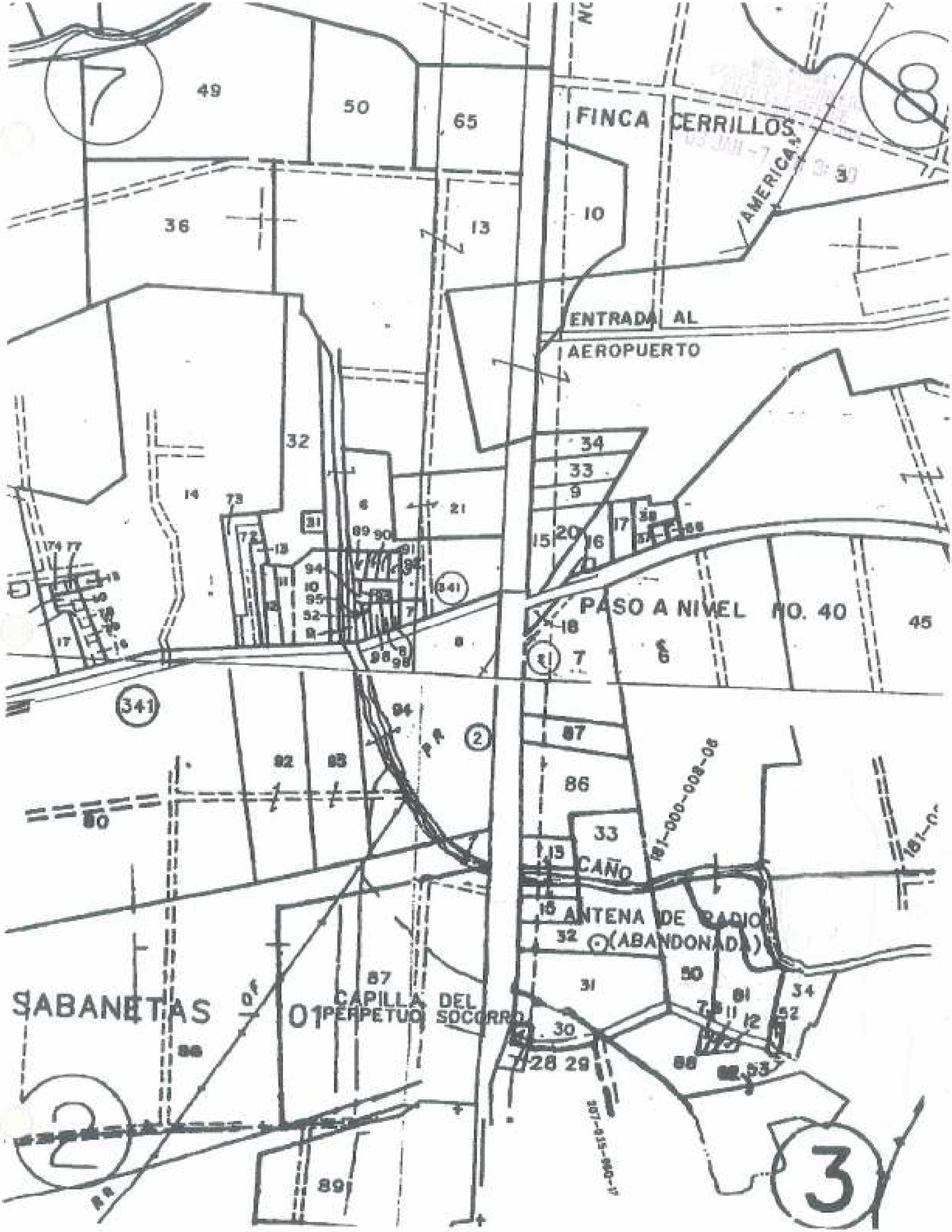
li recently got information fom Cesani Hardware, Inc. that this person alleged on Court that he is the owner, but at present the Case 1AC-1998-0214 in Mayagtiez Justice Court has not been solved. The above events confirmed that 1 was correct in the provided mailing addresses for adjoining property owners across PR-2, presently available on Corps Files. Nevertheless I am including Dr. Walter Silva's report including technical response to Comments 1 to 6 expressed on your letter dated December 4, 2002 with reference to above Joint Permit Application. In regard to Number 3 Comment and as we talk in telephone we are desisting the earth-Gabion bottom channel as well as the upper metal screens on the box culverts.

Lastly, the Number 7 Comment states: "It is our understanding that you should have obtained a WQC by now. If not, please provide the related information for us to determine if a waiver has occurred". A waiver for the WQC has occurred according to the 33CFR Part 320-330 which states that if the EQB has not given the Water Quality Certificate (WQC) within a year since the date (June 27, 2001) that the EQB certified that the Application of the WQC was completed. This means that legally that the WQC has been granted by the EQB even though it has not been written.

Thanking you in advance for the opportunity of commenting on this matter, and hoping to hear from you as soon as possible, remains,

Respectfully yours,

Dr. Ovidio Garcia Amador
President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CENTRO DE RECAUDACION DE INGRP7· 1UNICIPALES
ESTADO DE CUENTA/STATEMENT ACCOUNT

CATASTRO # CUENTA .)FCHA DE INTERESES/DESCUENTO
PIN # 207-000-003-15-000 ACCOUNT# 0130886, INT/DISC DATE 02/08/2002

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2003	RECO3	01/01/2003	102.46	10.25	0.00	0.00	92.21
2003	RECO3	01/07/2002	102.47	5.12	D.:0	0.00	97.35
GRAND TOTAL			204.93	15.37	C.00	0.00	189.56

LOCALIZACION
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CESANI HARDWARE *INC*
PO BOX 1209
MAYAGUEZ PR 00681

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2003	RECO3	01/01/2003	122.21	12.22	0.00	0.00	109.99
2003	RECO3	01/07/2002	122.22	6.11	3.:0	0.00	116.11
2002	RECO2	01/01/2002	122.21		4.11	12.22	138.t4
2002	RECO2	01/07/2001	122.22	0.00	10.27	12.22	144 *71*
2001	RECO1	01/01/2001	122.21	0.00	:6.33	12.22	150.76
2001	RECO1	01/07/2000	122.22	0.00	22 50	12.22	156.94
GRAND TOTAL			733.29	18.33	53.21	48.88	81[7].05

LOCALIZACION
LOCATION *7[4]0 5t,* .7•7:TAS MAYAGUEZ

CESANI HARDWARE INC
PO BOX 310
MAYAGUEZ PR 00681-0310

TOTAL A0717.;:_ADO AL CRIM
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Technical Response to some of the comments by the US Army Corps of Engineers to permit application number 199905598 (IP-ML)

Prepared by:

Walter F. Silva-Araya, Ph.D., P.E.

December 2002

Technical Response to some of the comments by the US Army Corps of Engineers to permit application number 199905598 (IP-ML)

I. Introduction

This report provides technical answers to comments 1 thru 6 expressed by the Antilles Regulatory Section of the Army Corps of Engineers in the letter dated December 4, 2002 with reference to permit application number **199905598 (IP-ML).** The concerns were expressed by a "property owner", whose name was not mentioned in the letter, who is taking care of the property adjoining the project limits east of the culvert on Boquilla Creek, at the crossing of highway PR-2. His major concern is the possibility of flooding of this property due to backflow or slow movement of the water through the proposed improved channels in El Mani Plaza site.

The comments were responded based on engineering calculations and photo evidence to provide strong criteria for final approval.

II. Answer to Comments, Questions or Explanations

Comments No. 1 and 2 are:

"Confirm or clarify

1) That the proposed channel A-A and G-G has the appropriate length and slope to maintain water flowing downstream. Certify that the water would not remain stagnant, or that backflow would not be produced at the channel.

2) That the proposed channel D-D provides the appropriate slope such that waters flowing through channel A-A and G-G would effectively drain, and would not remain stagnant or cause a backflow"

Answer:

Comments 1 and 2 are answered simultaneously, because the concerns are essentially the same; due to the fact that, channels A-A, G-G and D-D form a series system.

a) This concern is taken care of by recalling that channel A-A and channel G-G discharge into channel D-D. The top elevation of the west side of channel D-D is **2.85** meters (**page 55, H&H study**), the top elevation of the box culvert located at PR#2 is **3.55** meters (**page 50, H&H study**). Because water moves from upstream to downstream, it is easily concluded that water always will overtop the downstream channel D-D in his path toward the Caño Boquilla, before reversing direction,. **In fact, no flow reversal or backflow is possible in a gravity system unless water comes from the opposite direction.** The water sources for these channels are the watersheds upstream of PR#2; therefore, it is a matter of common sense to conclude in which direction the flow is moving. It is fair to say that **this condition is evident and was included in the H&H study.** By its own definition, backflow is impossible in this project.

b) It is not possible to certify that the water will not remain stagnant in the channels because, with no-inflow, any obstruction along channels D-D, G-G or A-A could left some water at rest, especially during the dry season. This is particularly sensitive at the culvert on PR-64. In the spirit of interpreting the expressed concern, let assume the worst case scenario. Consider a total clogging of this culvert, with inflowing water entering the channels; then, the water will overtop channel D-D, discharging in the adjacent lands on the west side of the project and over road PR-64. This situation has occurred in the past. Moreover; as long as an inflow exists, water will flow in the direction of the downstream slope surpassing any obstruction.

Comment No. 3 is:

"Please explain any effect of the high water table in restricting water drainage downstream the earth-gabion-bottom channel"

Answer:

The water table conditions in the surroundings will not be modified by the project. The H&H study recommends that the new channels be concrete lined everywhere **to avoid water infiltration from the bottom and to improve roughness conditions**. If groundwater infiltration occurs, the level in the channel will not be higher than the present conditions and, it will not modify the scenarios described in the H&H study or in this report. Water table levels will not make a significant difference between the response of the hydraulic system for the existing and for the proposed improved design conditions during critical design rainfall events.

Comment No. 4 is:

"Evaluate the alternative to place the proposed box culvert A-A in the current location of the Boquilla Creek (north-west orientation), and elongate it to the discharge point underneath PR-64. Discuss if this alternative would provide better slopes, such that the water does not remain stagnant, or backflow is caused."

Answer:

This comment is related to the general concern of any negative effect that the project may have in the unnamed "property owner", as stated in the third paragraph of the letter. The letter says that the owner is *"of the opinion that the proposed structure to relocate the Creek is not long enough and would not provide enough slope to maintain to flow of the water downstream, in a*

west, north west direction. He states that since the water table is high in the area and inadequate slope would promote that the water remains stagnant, or even may produce a backflow, affecting his property." Following the suggestion of the owner, now it is requested to evaluate the alternative of prolonging the culvert from PR#2 all the way down to PR#64. The following analysis is the response to this concern:

a) During December 2002 the Department of Natural Resources cleaned and widened channel D-D. The conditions after the clearing and cleaning are shown in Figure 1. Water is flowing downstream, even though; the culvert at PR#64 is clogged, as shown in Figure 2. It is evident that the channel improvements will benefit the water movement along the project; however, the culvert capacity is always a limiting factor. It is important to recall that, the project improves the local conditions and do not worsen upstream or downstream conditions. This is the requirement to complain with existing regulations; but, the project do not pretend, and is not requested to, solve the problems beyond the project limits.

b) Stagnant and backflow conditions were discussed in previous paragraphs. The concern of the appropriate slope for channels A-A and G-G was attended by using a minimum overtopping condition, because, large events were analyzed in the H&H study with the purpose of complying with the Regulation No 3. The Department of Natural Resources approved that analysis in November 2001.

Minimum Overtopping Condition

The gradually varied flow analysis demonstrates that channel D-D will be overtopped for a discharge less than 7.5 m^3/s. This channel collects water from all the watersheds converging to the El Maní Plaza project (previously called Elite Valley Center).

Assuming a discharge of 7.5 m^3/s and splitting the contribution between the proposed channel A-A (which carries the same flow as the existing channel B-B) and the existing culvert-channel system coming from the other watersheds on the southeast (PepBoys channel), the estimated contribution of the Boquilla Creek would be about 54% of the 7.5 m^3/s. This estimate was obtained from the proportions for these watersheds from the results of the 5yrs-3hrs event from Appendix C of the H&H study.

The HEC-RAS models used for the H&H study were run for these conditions. The following analysis was done:

1) A discharge curve was obtained for the most downstream cross section. This section corresponds to Section 0 in the model titled "Canal Hacia el Norte". This model was called "Sistema Mani-Boquilla" in the H&H study (Appendix G), but, the new name is more accurate. The discharge curve is given in Figure 3.
2) Gradually varied flow computations were done in order to find the channel-forming discharge (the discharge that produces overflow) for channel D-D. The resultant flow is 7.5 m^3/s. The elevation at the downstream section corresponding to this discharge is 2.29 m. The model predicted overflowing at the culvert on PR#64. Figure 4 presents the results showing channel D-D overtopped for 7.5 m^3/s. The overflow elevation along channel D-D is 2.85 meters, as stated in

the H&H study (page 55). Appendix 1 presents the results for this analysis.

3) The water surface profile from step 2 predicted a water elevation at the beginning of channel D-D of 2.95 meters.
4) A flow of 0.54x7.5 = 4.05 m^3/s was used along the model for Boquilla Creek, called "Atarjea Quebrada Boquilla" in the H&H study (Appendix E). This model was improved by adding two more sections inside the property under study. The extended model was called "Atarjea Quebrada Boquilla Extendido" (Appendix 2 of this report). These computations allowed knowing if the property would be flooded by the new design before the new improved channel system will overflow.

The results, presented in Table 1, show that the water elevation at the culvert at PR#2 is 2.95 meters. This value is below the top chord elevation. The culvert is operating normally, and the upstream side will not be surcharged. The flow velocities are about 0.2 m/s. The channel will be overtopped upstream from the culvert site, inside the property under discussion (see Figure 5). The calculations demonstrate that the flooding conditions are not because of the culvert capacity or the Mani Plaza channels, but, because of the lack of maintenance of the Boquilla Creek to the east of PR#2. Figure 6 shows a recent picture of this channel (December, 2002). Vegetation has invaded the main channel; water finds a large resistance to flow. Presently, the same conditions are found on the El Mani Plaza side of the PR#2, as shown in Figure 7. The field inspection reveals that flow is stagnant due to the excessive vegetation and lack of infiltration capacity. The contrast with the cleaned and widened channel D-D, shown in Figure 1, is evident. All the pictures were taken the same day. The proposed conditions will solve this

problem on the side of Many Plaza. If a real concern for flooding of the adjacent land exists, the interested party should be providing maintenance to his channel.

Slope analysis

The proposed channel A-A has bottom slope of 0.303% (page 50, H&H study). This slope was improved, compared to the irregular present conditions. Channel D-D has a slope of 0.011% (page 55, H&H study), slightly improved over the existing conditions. The proposed slopes are steeper than the existing and are in harmony with the present drainage patterns.

Table 1. Results of the Low Flow Analysis

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	Vel Chnl (m/s)
5	4.05	2.46	2.96		0.856
4	4.05	1.77	2.96		0.201
3	4.05	1.21	2.95	1.84	0.294
2.5	Culvert				
2	4.05	0.53	2.95	0.83	0.209
1.8	4.05	0.44	2.95	0.74	0.202
1.6	4.05	0.35	2.95	0.64	0.195
1.4	4.05	0.26	2.95	0.55	0.188
1	4.05	0.16	2.95	0.46	0.181

Analysis of the long-culvert alternative suggested in the letter

The data for the suggested long culvert is the following:

Length = 390 meters (3.2 times longer than the proposed in the H&H)

Bottom elevation upstream = 0.53 m (same as the existing culvert on PR-#2)

Bottom elevation downstream = 0.38 m (same as existing culvert on PR#64)

Slope = 0.038%

Channel width = 8 meters (same as proposed in the H&H study)

Discharge = 4.05 m3/s (low flow conditions for the proposed H&H)

Roughness coefficient = 0.014 (concrete lined)

Water depth at the PR#64 culvert = 2.94 m (obtained from step 3 of the previous minimum overtopping analysis)

Due to the existing control structures (the culverts at PR#2 and PR#64), the long-culvert slope would be fixed to 0.038%. This value is smaller than the value of 0.303% used in the shorter culvert proposed in the H&H study.

Another calculation was done by using the energy equation assuming a 390 meters long culvert to compute the water depth at the PR#2. The result gives a water depth at the PR#2 culvert of **2.42 meters**. The water surface elevation is 2.42 + 0.53 = **2.95 meters, same result as the alternative proposed in the H&H study**. This result was expected based on the explanations given in page 54, last paragraph, of the H&H study.

Comparing the long-culvert alternative with the shorter culvert proposed in the H&H study, the long culvert will produce the same water elevation at the outlet of the culvert at PR#2. However, the long culvert will concentrate water close to the PR-64, aggravates local flooding conditions, and will be difficult to provide maintenance. Conversely, the configuration proposed in the H&H study distributes excess flow along the west side of the project, when channel D-D is overtopped, is a shorter culvert, is easy to maintain and was already approved by the Department of Natural Resources of Puerto Rico. Distributed overland flow is a better alternative than concentrated flow at the PR-64 culvert.

Comment 5:

"Clarify how do you propose to join the proposed culvert A-A, which is 8 meters wide, with the existing underneath PR-2, which is 6 meters wide."

Answer:

The join of the old and new culvert will be done by using a **channel transition**. Hydraulic transitions are common design practice in flood control channels. As accepted engineering practice, design and construction details must be included by the project developer for approval by ARPE. Cylinder quadrant, wedge or warped wall, are a few alternatives for this transition.

Comment 6:

"Clarify if you propose improvements to the culvert underneath PR-64, which is the discharge point of the proposed channels. If not, explain how you would manage water flows at the channels if this point is clogged. Is the capacity of the culvert underneath PR-64 compatible with the proposed dimensions of channel D-D? Would the culvert have the hydrological capacity to manage the water loads flowing through the new channel?"

Answer:

As mentioned in Answer to Comment No. 4, the capacity of the culvert at PR-64 is a limiting factor. It is evident that, neither the culvert at PR-2 nor the one at PR-64 have the hydraulic capacity for the design flows. This was clearly stated in the H&H study (page 54, last paragraph).

The H&H study computations were done assuming that the two 4.5 feet culverts at the PR-64 are fully operational and clean. Under fully clogged conditions the water overtops road PR-64. Plans for improvements (re-sizing) the culvert would have to be decided by the Puerto Rico Highway Authority. However, recall that highway drainages are usually designed for events of smaller magnitude than flood channels; therefore, most probably, the culvert will never be sized for the Q_{100}. It is obvious that this decision is beyond the project owner. **To enforce the improved design measures it is**

strongly recommended that the project owner provides maintenance to the new channels, the new culverts, as well as the culvert at PR-64; keeping the channels clean (do not allowing to accumulate sediments) and the culverts clean and fully open.

III. Conclusions

1. There will not be any adverse effect on the adjacent property in front of culvert on PR#2 due to the improvement in the channels of El Mani Plaza project, as proposed in the H&H study.

2. Backflow is an impossible condition when flow is coming from the upstream watersheds.

3. The culvert suggested in the letter will produce the same water levels near the neighboring property under discussion. Moreover, the following negative impacts are foreseen for this configuration: will cause flow concentration near PR-64 and possible aggravating effects on the, already sensitive, local flooding conditions; and will be more difficult for maintenance service. This alternative is not better than the H&H solution.

4. It is impossible to certify that water will not remain stagnant within the project limits because this is a possible condition when no inflow is coming into the channel system. If inflow exist, the worst case scenario, corresponding to a total clogging of the culvert at PR-64, will produce overtopping of channel D-D and discharge of water into the adjacent land to the west. The land under discussion will not be flooded, more than what is flooded under the present conditions, due to water stagnation inside the El Mani Plaza project.

5. Water table levels will not make a significant difference between the response of the hydraulic system for the existing and for the proposed improved design conditions during critical design rainfall events.

6. Poor channel conditions in the adjacent channel to the east of the PR#2 culvert (property of the concerned person) are evident. If a real concern of flooding of the adjacent land exists, the interested party should provide maintenance to his channel. No sign of this concern are visible at present.

7. The channel improvements will benefit the water movement in the project area; however, the capacity of the culvert at PR-64 is always a limiting factor. The project improves the local conditions and do not worsen upstream or downstream conditions; but, do not pretend and is not requested to, solve the problems beyond the project limits.

8. To enforce the improved design measures it is strongly recommended that the project owner provides maintenance to the new channels, the new culverts, as well as the culvert at PR-64; keeping the channels clean (do not allowing to accumulate sediments) and the culverts clean and fully open.

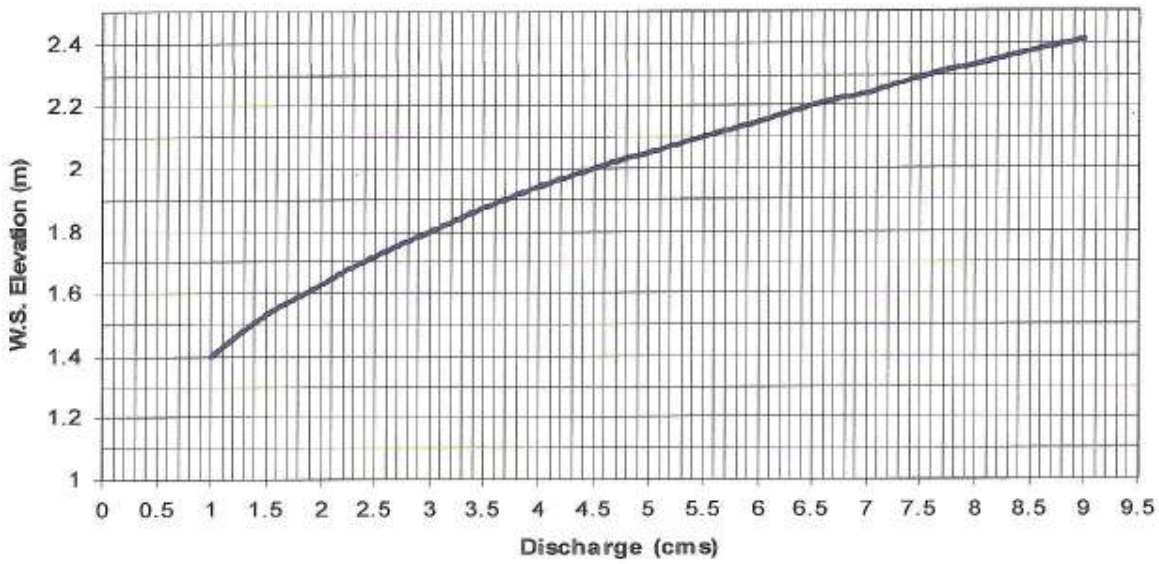
9. Some of the concerns raised in this letter were mostly intuitive instead of supported by sound engineering principles. Nevertheless, comprehensive answers were provided with the expectation that those would be satisfactory for final approval of El Mani Plaza shopping center.

FIGURES

Figure 1. Channel D-D (December 2002)

Figure 2. Culvert submerged on PR-64 (December, 2002)

Figure 3. Discharge Curve for Downstream Cross Section



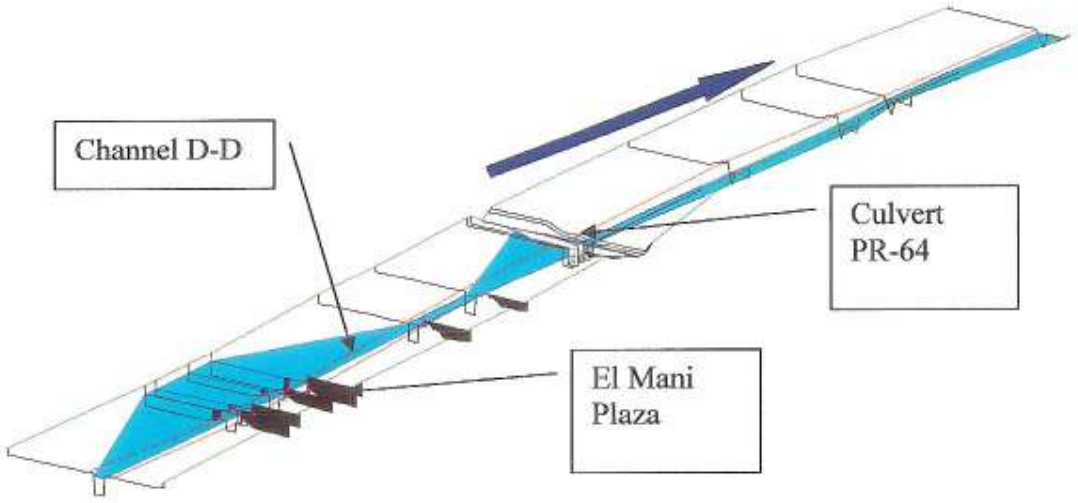


Figure 4. Schematic showing overtopping of Channel D-D, Q=7.5 m^3/s

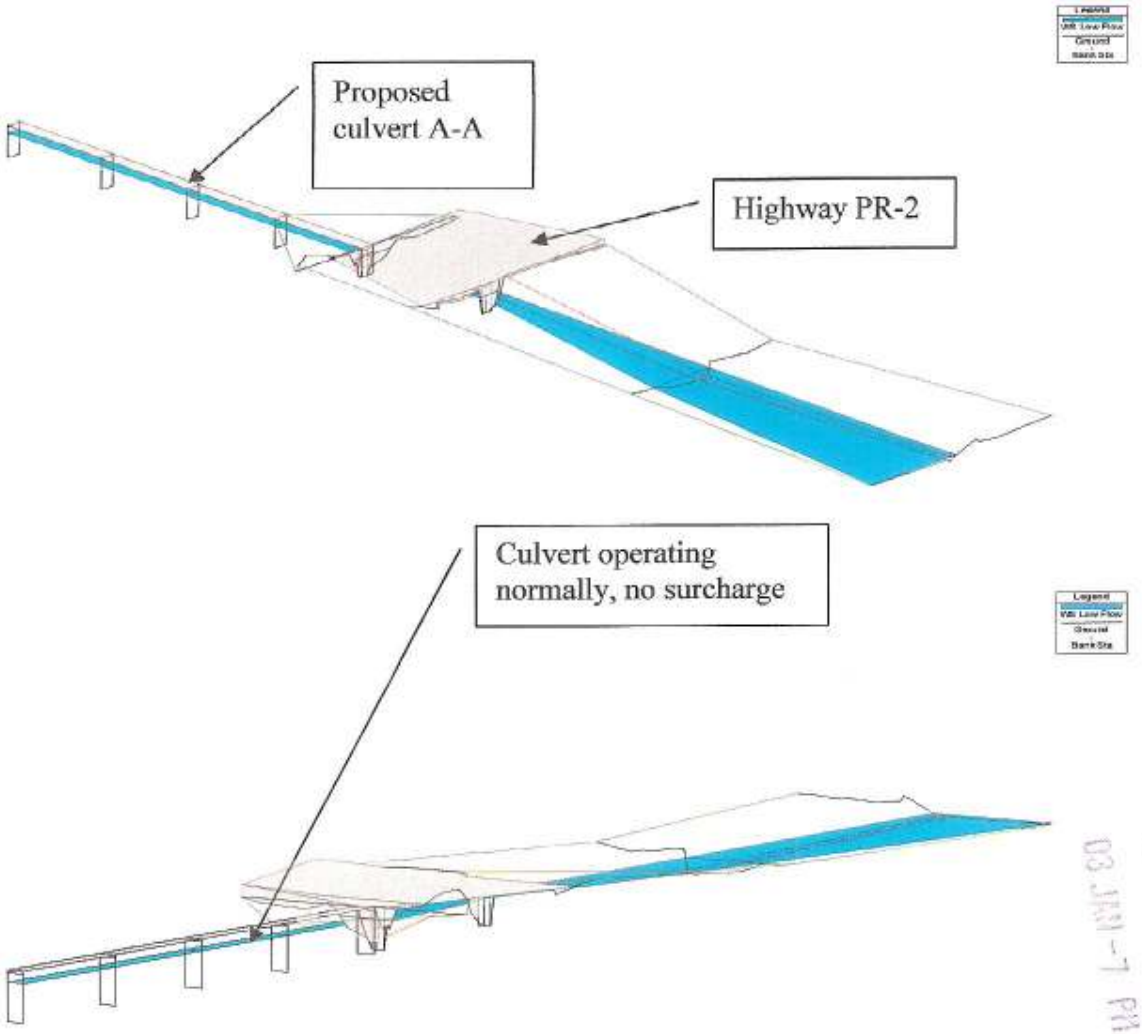


Figure 5. Computer results showing normal operation of culvert on PR-#2

Figure 6. Channel conditions to the east of the culvert at PR-2 (Channel under concern)

Figure 7. Channel conditions to the west of the culvert at PR-2 (to be improved)

APPENDICES

COMPUTER RESULTS FOR LOW-FLOW ANALYSIS

HEC-RAS Version 3.0.1 Mar 2001
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X  X     X  X     X
X     X  X        X            X  X     X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X       X
X     X  X        X    X       X  X     X    X       X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Canal hacia el norte
Project File : Canalhaciaelnorte.prj
Run Date and Time: 12/29/2002 12:40:41 AM

Project in SI units

Project Description:
Canal hacia el norte. Recoge todas las aguas desde Pep-Boys hasta la PR-64. Se dirije hacia el Cano Boquilla.

PLAN DATA

Plan Title: Canal mejorado 100
Plan File : C:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Canal hacia el Norte\Canalhaciaelnorte.p13

Geometry Title: Canal nuevo
Geometry File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Canal hacia el Norte\Canalhaciaelnorte.g08

Flow Title : Distribución con Diseno
Flow File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Canal hacia el Norte\Canalhaciaelnorte.f06

Plan Description:
Canal trapezoidal propuesto. Colinda con Elite Valley al oeste Va desde el Centro Comercial Western Plaza hasta las alcantillas que cruzan al PR-64

Plan Summary Information:
Number of: Cross Sections = 14 Mulitple Openings = 0
Culverts = 1 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculaton tolerance = 0.003
Maximum number of interations = 20
Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Distribución con Diseno
Flow File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Canal hacia el Norte\Canalhaciaelnorte.f06

Flow Data (m3/s)

River	Reach	RS	100yrs 24hrs	MinNonOverflow
Mani-Boquilla	PepBoys-Union1	7	125.4	7.5
Mani-Boquilla	PepBoys-Union1	5	126.77	7.5

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mani-Boquilla	PepBoys-Union1	100yrs 24hrs		Critical
Mani-Boquilla	PepBoys-Union1	MinNonOverflow		Known WS = 2.29

GEOMETRY DATA

Geometry Title: Canal nuevo
Geometry File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Canal hacia el Norte\Canalhaciaelnorte.g08

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 7

INPUT
Description: Salida de Atarjea detras de Pep-Boys
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	3.16	27.25	3.18	39.39	3.26	42	3.26
47	3.26	47.98	.42	57.98	.42	59.4	3.26	66.146	3.26
68.56	3.26	91.28	3.17	105.78	3.18	115.78	3.2	125.25	3.32
126	4.2								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	42	.014	59.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
39.39	68.56	108.5	108.5	.1	.3

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 6.5

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	1.27	12.81	1.21	26.56	1.34	35.63	1.74
42	1.74	42.43	.408	52.43	.408	53.096	1.74	58.713	1.74
61.23	2.27	73.53	1.55	79.92	1.49	86.58	1.4	94.9	1.42
101.85	1.31	112.5	1.28	113	4.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	35.63	.014	53.096	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
35.63	61.23	9.42	9.42	.1	.3

Left Levee Station= 35.63 Elevation= 2.85
Right Levee Station= 58.1 Elevation= 3.76
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
26.5	36.63	2.85	58.1	113	3.76

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 6

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	1.85	12.81	1.79	26.56	1.92	37	2.32
42	2.32	42.43	.407	52.43	.407	53.387	2.32	58.713	2.32
61.23	2.32	73.53	2.13	79.92	2.07	86.58	1.98	94.9	2
101.85	1.89	112.5	1.86	113	4.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	37	.014	61.23	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
37	61.23	26.59	26.59	.1	.3

Left Levee Station= 37 Elevation= 2.85
Right Levee Station= 58.39 Elevation= 3.76
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
32	37	2.85	58.39	113	3.76

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 5.8

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	1.78	12.81	1.72	26.56	1.85	37	2.25
42	2.25	42.43	.404	52.43	.404	53.353	2.25	58.713	2.25
61.23	2.78	73.53	2.06	79.92	2	86.58	1.91	94.9	1.93
101.85	1.82	112.5	1.79	113	4.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	37	.014	61.23	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
37	61.23	19.43	19.43	.1	.3

Left Levee Station= 37 Elevation= 2.85
Right Levee Station= 58.35 Elevation= 3.76
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
32	37	2.85	58.35	113	3.76

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 5.6

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	.94	12.81	.88	26.56	1.01	37	1.41
42	1.41	42.42	.402	52.43	.402	52.934	1.41	58.713	1.41
61.23	1.94	73.53	1.22	79.92	1.16	86.58	1.07	94.9	1.09
101.85	.98	112.5	.95	113	4.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	37	.014	61.23	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
37	61.23	94.75	94.75	.1	.3

Left Levee Station= 37 Elevation= 2.85
Right Levee Station= 57.93 Elevation= 3.76
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
32	37	2.85	57.93	113	3.76

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 5

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	3	47	2.95	52	2.95	52.23	.392
62.23	.392	63.509	2.95	70.799	2.95	71.7	3.22	77.28	3.36
79.22	2.88	81.7	3.08	87.12	2.61	91.65	1.94	98.76	2.02
108.85	1.97	121.53	2.22	122	4.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	47	.014	71.7	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
47	71.7	47.13	47.13	.1	.3

Right Levee Station= 68.95 Elevation= 3.76

Blocked Obstructions num= 1

Sta L	Sta R	Elev
68.95	122	3.76

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 4.5

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	3.45	47	3.4	52	3.4	52.23	.386
62.23	.386	63.737	3.4	70.799	3.4	71.7	3.67	77.28	3.81
79.22	3.33	81.7	3.53	87.12	3.06	91.65	2.39	98.76	2.47
108.85	2.42	121.53	2.67	122	4.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	47	.014	71.7	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
47	71.7	80.39	80.39	.1	.3

Right Levee Station= 76.7 Elevation= 3.76
Blocked Obstructions num= 1

Sta L	Sta R	Elev
76.7	122	3.76

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 4

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	3.07	5.68	2.92	20.67	2.9	41.67	2.77
43	2.81	58	2.81	58.68	.378	68.68	.378	69.896	2.81
75	2.81	81.18	2.83	91.34	2.65	102.53	3.07	116.09	2.94
117	4.2								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	43	.014	75	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
43	75	15	15	.1	.3

Right Levee Station= 74.9 Elevation= 3.2
Blocked Obstructions num= 1

Sta L	Sta R	Elev
74.9	117	3.2

CULVERT RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 3

INPUT
Description:
Distance from Upstream XS = 2.3
Deck/Roadway Width = 8
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 18

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-254.79	2.06		-140.17	2.93		-82.7	2.92	
-49.65	2.88		-22.42	2.84		2.17	2.87	
36.5	2.95		52.28	2.86		70.98	2.73	
87.16	2.78		115.67	2.86		144.15	2.98	
173.48	3.12		205.21	3.17		230.76	3.24	
249.83	3.38		274.2	3.34		288.72	3.49	

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.2	-50	3.07	5.68	2.92	20.67	2.9	41.67	2.77
43	2.81	58	2.81	58.68	.38	68.68	.38	69.9	2.81
75	2.81	81.18	2.83	91.34	2.65	102.53	3.07	116.09	2.94
117	4.2								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	43	.03	75	.05

```
Bank Sta: Left   Right     Coeff Contr.   Expan.
           43      75            .1          .3
Right Levee      Station=     74.9       Elevation=     3.2
Blocked Obstructions      num=        1
   Sta L    Sta R     Elev
    74.9      117      3.2

Downstream  Deck/Roadway Coordinates
    num=       18
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
 -254.79     2.06          -140.17     2.93           -82.7     2.92
  -49.65     2.88           -22.42     2.84            2.17     2.87
    36.5     2.95            52.28     2.86           70.98     2.73
   87.16     2.78           115.67     2.86          144.15     2.98
  173.48     3.12           205.21     3.17          230.76     3.24
  249.83     3.38            274.2     3.34          288.72     3.49

Downstream Bridge Cross Section Data
Station Elevation Data    num=       13
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     -50        3      -50      2.9    30.86     2.77    47.65     2.73    55.65     2.56
   57.67       .12    61.63       .12  64.51     2.15    65.92     2.47    68.55     2.76
   89.48     2.81     104.3     2.74   123.7     2.73

Manning's n Values        num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     -50     .035    47.65      .03    68.55     .035

Bank Sta: Left   Right     Coeff Contr.   Expan.
          47.65  68.55          .1          .3

Upstream Embankment side slope                  =      0 horiz. to 1.0 vertical
Downstream Embankment side slope                =      0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow     =    .95
Elevation at which weir flow begins             =
Energy head used in spillway design             =
Spillway height used in design                  =
Weir crest shape                                = Broad Crested

Number of Culverts =  1

Culvert Name      Shape      Rise     Span
Culvert #1       Circular    1.37
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length     n Value   Entrance Loss Coef   Exit Loss Coef
                 2.3       8       .013                  .5                1
Number of Barrels =  2
Upstream   Elevation =  0.7
Centerline Stations
    Sta.      Sta.
   62.47     64.75
Downstream Elevation =  0.12
Centerline Stations
    Sta.      Sta.
      58     60.28

CROSS SECTION          RIVER: Mani-Boquilla
REACH: PepBoys-Union1     RS: 2

INPUT
Description:
Station Elevation Data    num=       15
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     -50      4.1      -50     3.86     13.5     3.86    30.86     2.77    47.65     2.73
   55.65     2.56    57.67       .12  61.63       .12  64.51     2.15    65.92     2.47
   68.55     2.76    89.48     2.81   104.3     2.74   123.7     2.73     130       4.2

Manning's n Values        num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     -50      .05    47.65     .035    68.55      .05

Bank Sta: Left   Right     Lengths: Left Channel   Right     Coeff Contr.   Expan.
          47.65  68.55                 2.3     2.3     2.3          .1          .3

CROSS SECTION          RIVER: Mani-Boquilla
REACH: PepBoys-Union1     RS: 1.8
```

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.32	-50	4.08	13.5	4.08	30.86	2.99	47.65	2.95
55.65	2.78	57.67	.34	61.63	.34	64.51	2.37	65.92	2.69
68.55	2.98	89.48	3.03	104.3	2.96	123.7	2.95	130	4.42

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	47.65	.035	68.55	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
47.65	68.55	116.98	116.98	.1	.3

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 1

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4	-50	3.14	40.85	3.12	47.71	3.56	56.32	3.89
57.27	3.68	60	4.15	66.16	.88	68.99	2.46	70.53	2.64
84.39	2.37	85	4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	60	.035	70.53	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	70.53	87.46	87.46	.1	.3

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 0.5

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4	-50	2.54	40.85	2.52	47.71	2.96	56.32	3.29
57.27	3.08	60	3.55	66.16	.28	68.99	1.86	70.53	2.04
84.39	1.77	85.5	4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	60	.035	70.53	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	70.53	39.07	39.07	.1	.3

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 0.01

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	4.5	-50	3	51.04	3	60	.61	63.01	2.04
63.95	2.78	82.27	2.52	83	4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	51.04	.035	63.95	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
51.04	63.95	120	120	.1	.3

CROSS SECTION RIVER: Mani-Boquilla
REACH: PepBoys-Union1 RS: 0

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	3	-50	2.76	45.6	2.76	51.04	2.76	60	.37
63.01	1.8	63.95	2.54	82.27	2.28	90	3		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-50	.05	51.04	.035	63.95	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
51.04	63.95	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Mani-Boquilla

Reach	River Sta.	n1	n2	n3
PepBoys-Union1	7	.05	.014	.05
PepBoys-Union1	6.5	.05	.014	.05
PepBoys-Union1	6	.05	.014	.05
PepBoys-Union1	5.8	.05	.014	.05
PepBoys-Union1	5.6	.05	.014	.05
PepBoys-Union1	5	.05	.014	.05
PepBoys-Union1	4.5	.05	.014	.05
PepBoys-Union1	4	.05	.014	.05
PepBoys-Union1	3	Culvert		
PepBoys-Union1	2	.05	.035	.05
PepBoys-Union1	1.8	.05	.035	.05
PepBoys-Union1	1	.05	.035	.05
PepBoys-Union1	0.5	.05	.035	.05
PepBoys-Union1	0.01	.05	.035	.05
PepBoys-Union1	0	.05	.035	.05

SUMMARY OF REACH LENGTHS

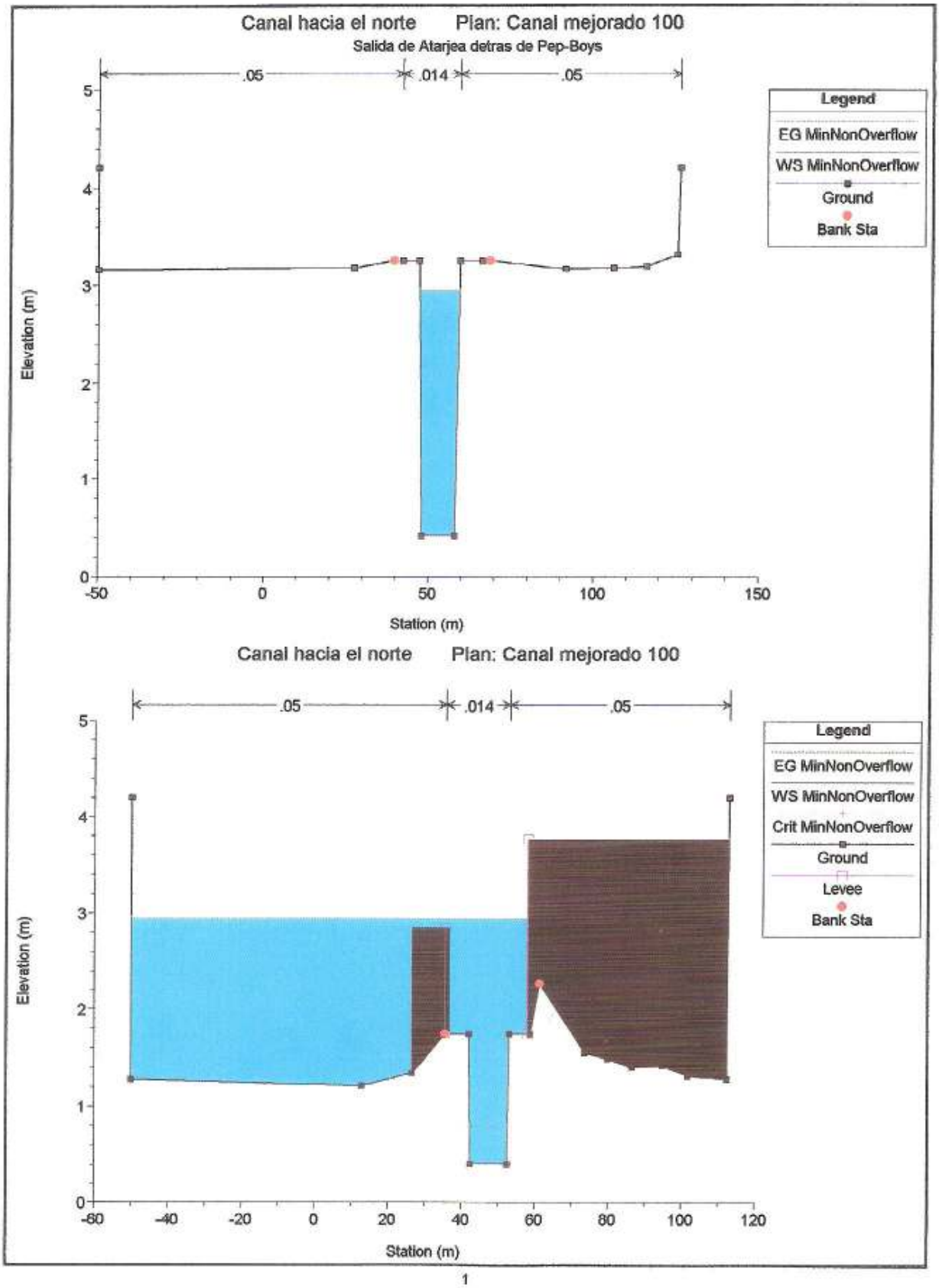
River: Mani-Boquilla

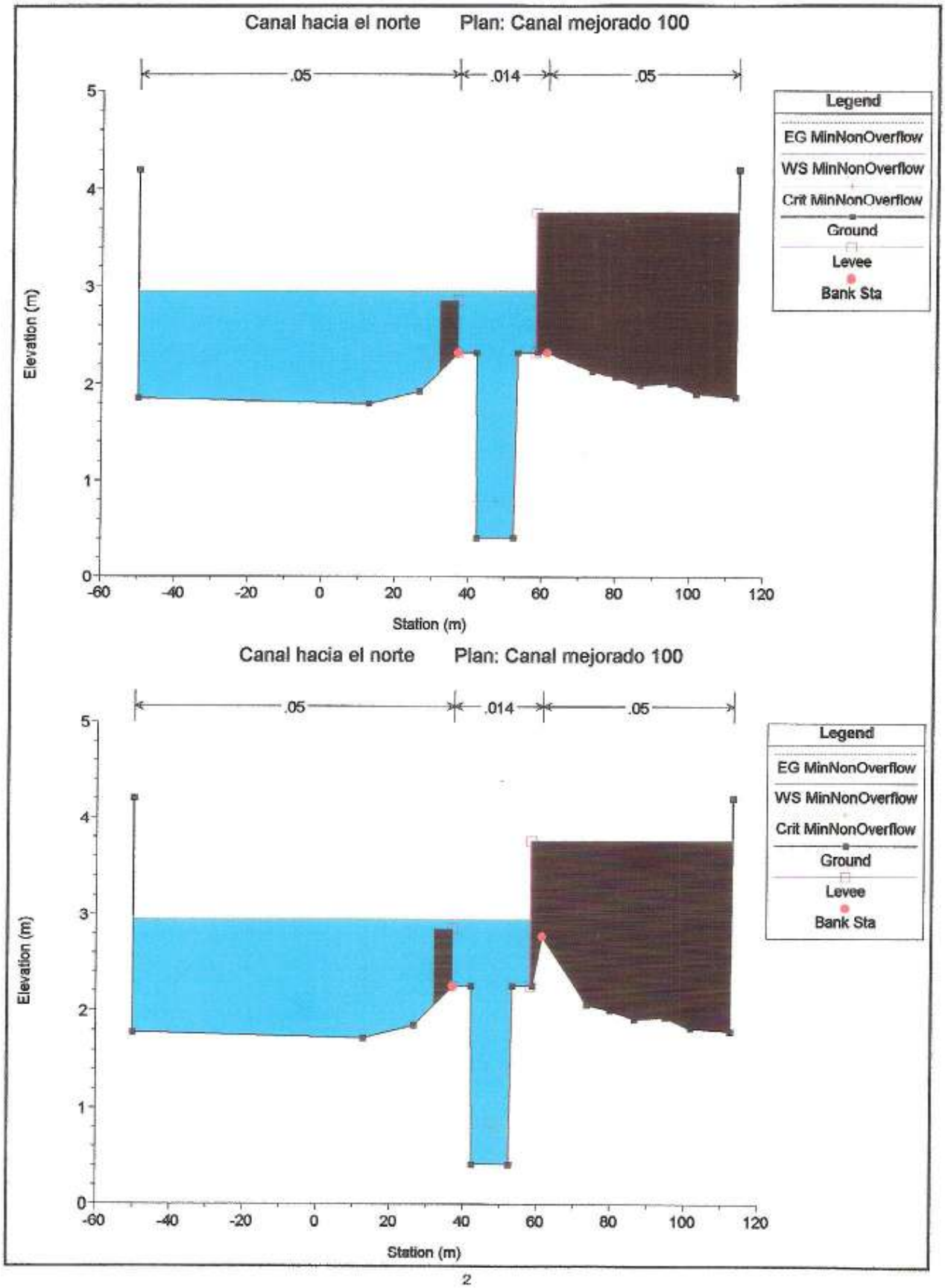
Reach	River Sta.	Left	Channel	Right
PepBoys-Union1	7	108.5	108.5	108.5
PepBoys-Union1	6.5	9.42	9.42	9.42
PepBoys-Union1	6	26.59	26.59	26.59
PepBoys-Union1	5.8	19.43	19.43	19.43
PepBoys-Union1	5.6	94.75	94.75	94.75
PepBoys-Union1	5	47.13	47.13	47.13
PepBoys-Union1	4.5	80.39	80.39	80.39
PepBoys-Union1	4	15	15	15
PepBoys-Union1	3	Culvert		
PepBoys-Union1	2	2.3	2.3	2.3
PepBoys-Union1	1.8	116.98	116.98	116.98
PepBoys-Union1	1	87.46	87.46	87.46
PepBoys-Union1	0.5	39.07	39.07	39.07
PepBoys-Union1	0.01	120	120	120
PepBoys-Union1	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Mani-Boquilla

Reach	River Sta.	Contr.	Expan.
PepBoys-Union1	7	.1	.3
PepBoys-Union1	6.5	.1	.3
PepBoys-Union1	6	.1	.3
PepBoys-Union1	5.8	.1	.3
PepBoys-Union1	5.6	.1	.3
PepBoys-Union1	5	.1	.3
PepBoys-Union1	4.5	.1	.3
PepBoys-Union1	4	.1	.3
PepBoys-Union1	3	Culvert	
PepBoys-Union1	2	.1	.3
PepBoys-Union1	1.8	.1	.3
PepBoys-Union1	1	.1	.3
PepBoys-Union1	0.5	.1	.3
PepBoys-Union1	0.01	.1	.3

PepBoys-Union1	0	.1	Canalhaciaelnorte.rep .3


Canal hacia el norte Plan: Canal mejorado 100
Salida de Atarjea detras de Pep-Boys
.05
.014
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Ground
Bank Sta
Elevation (m)
Station (m)
Canal hacia el norte Plan: Canal mejorado 100
.05
.014
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Levee
Bank Sta
Elevation (m)
Station (m)


Canal hacia el norte Plan: Canal mejorado 100
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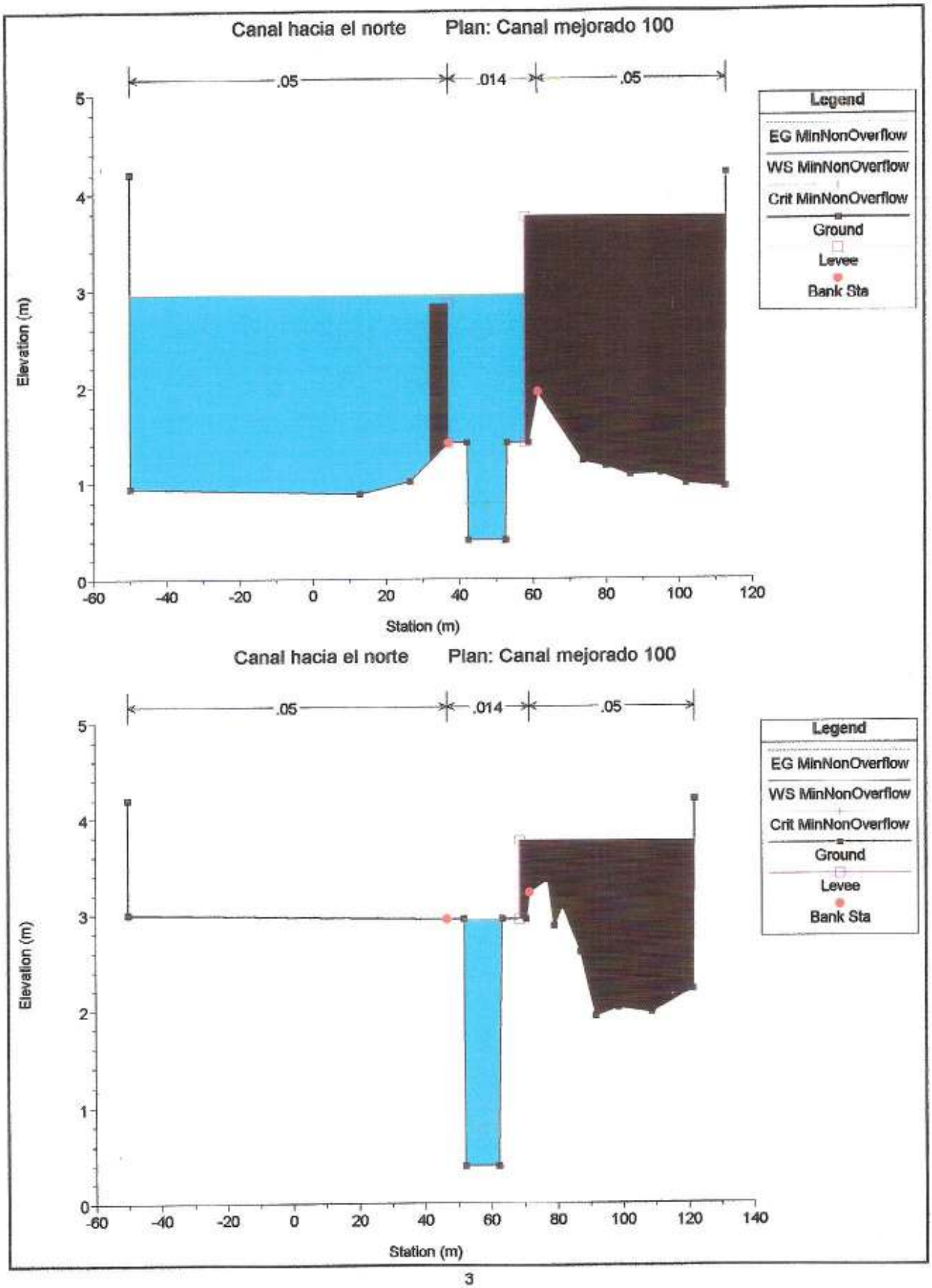
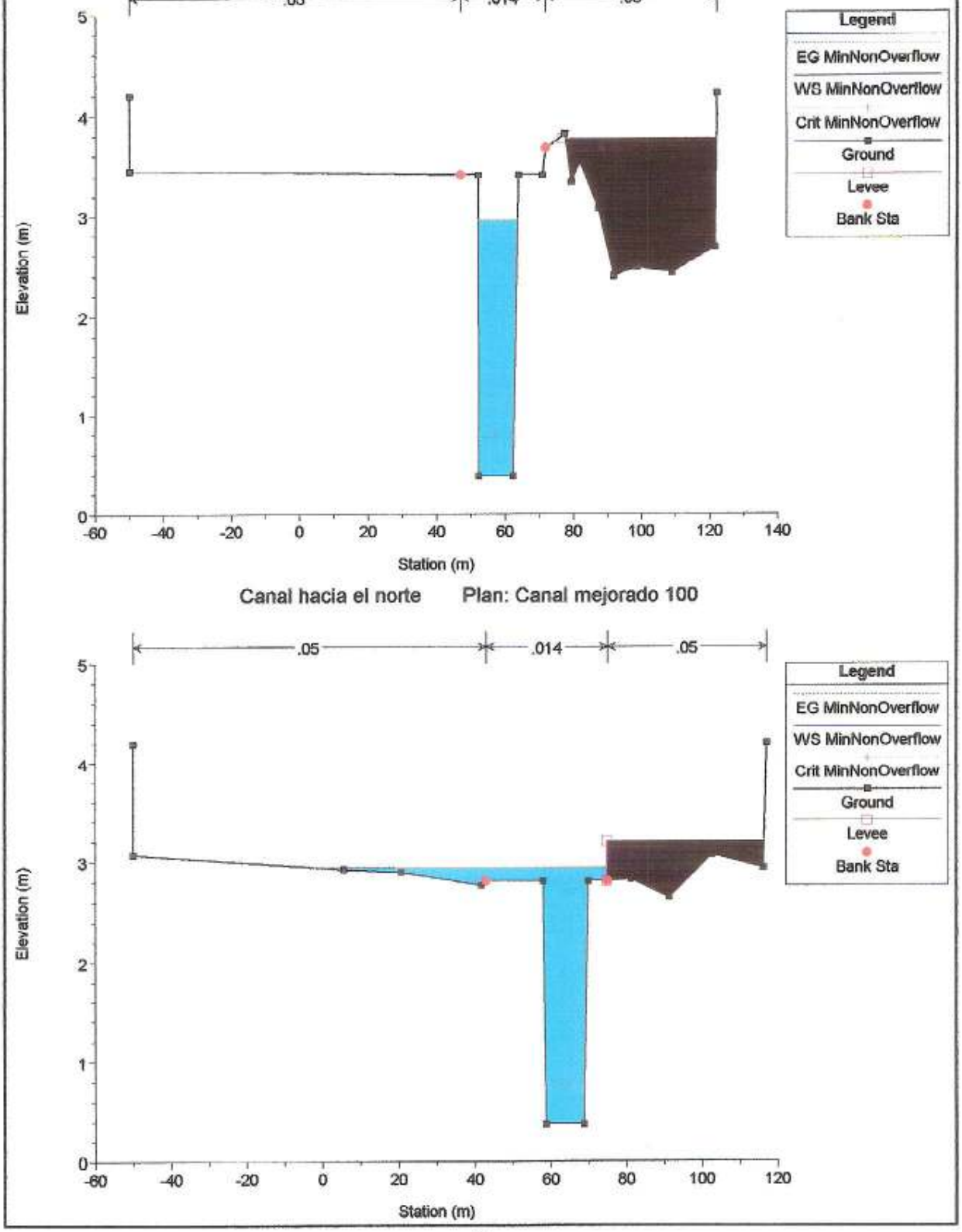
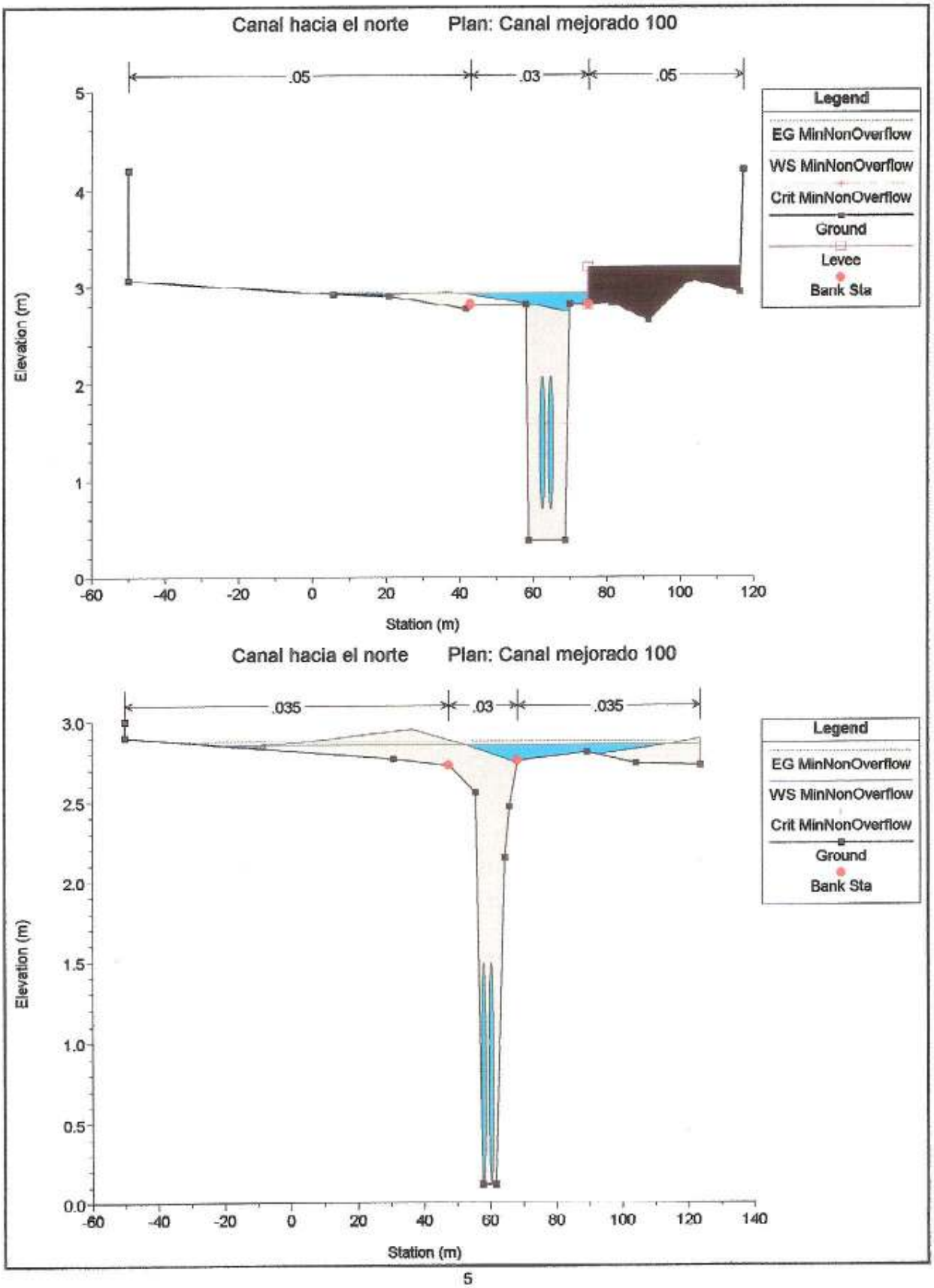
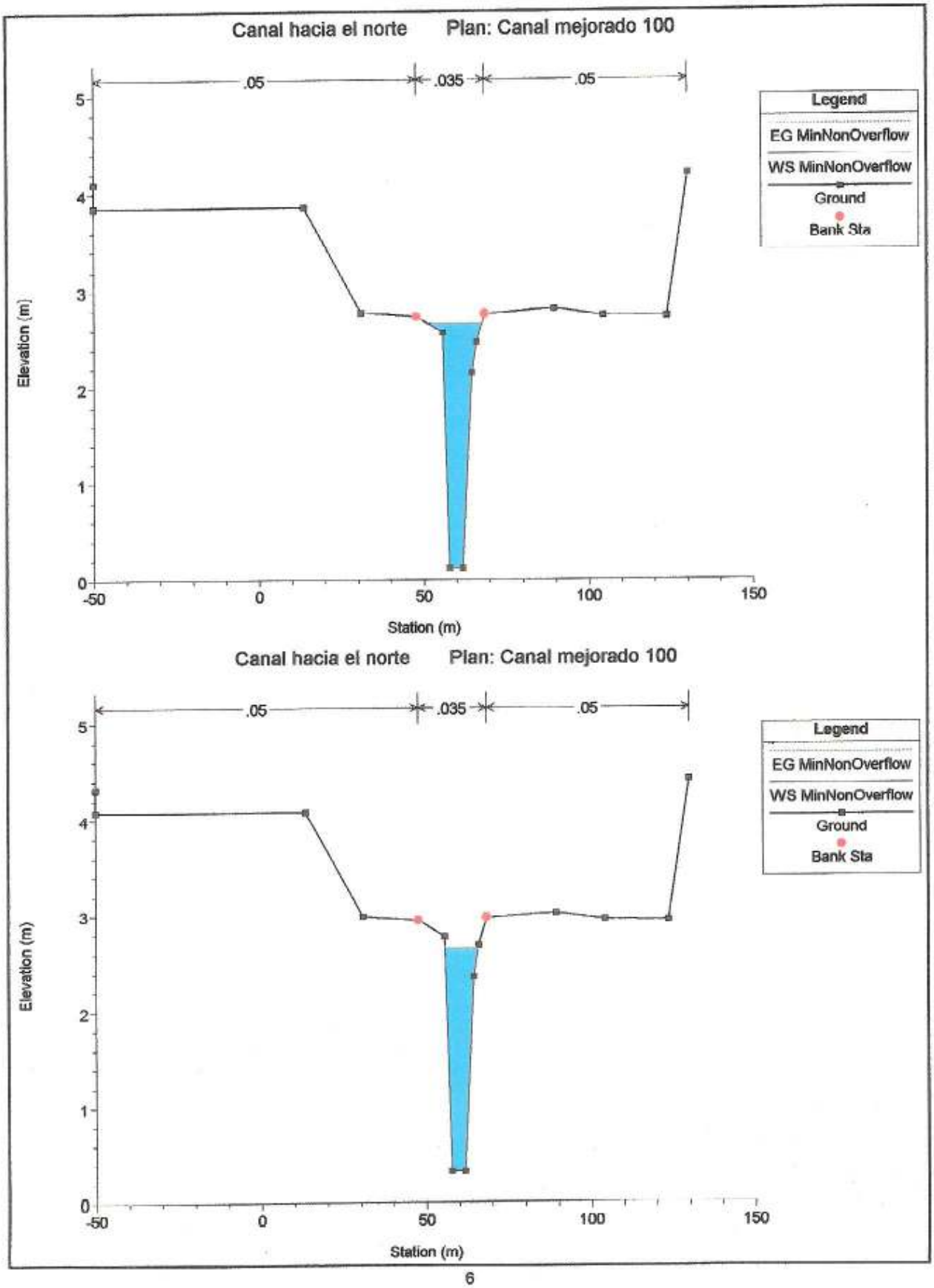
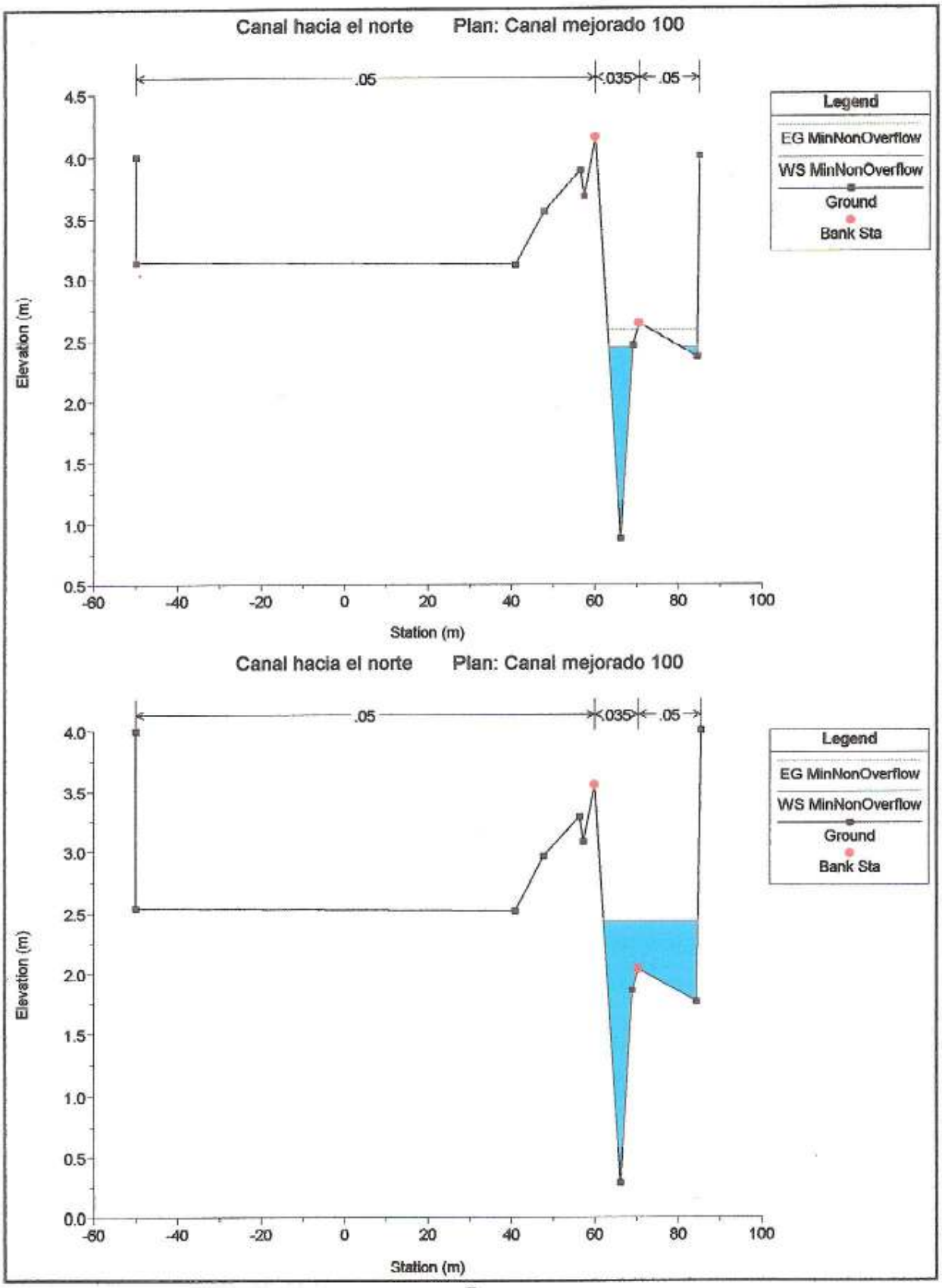
.014
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
Canal hacia el norte Plan: Canal mejorado 100
.05
.014
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Levee
Bank Sta
Elevation (m)
Station (m)


Canal hacia el norte Plan: Canal mejorado 100
.05
.014
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
Canal hacia el norte Plan: Canal mejorado 100
.05
.014
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Levee
Bank Sta
Elevation (m)
Station (m)


Canal hacia el norte Plan: Canal mejorado 100
.05
.014
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
Canal hacia el norte Plan: Canal mejorado 100
.05
.014
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Levee
Bank Sta
Elevation (m)
Station (m)


Canal hacia el norte Plan: Canal mejorado 100
.05
.03
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
Canal hacia el norte Plan: Canal mejorado 100
.035
.03
.035
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Bank Sta
Elevation (m)
Station (m)


Canal hacia el norte Plan: Canal mejorado 100
.05
.035
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Ground
Bank Sta
Elevation (m)
Station (m)
0
1
2
3
4
5
-50
0
50
100
150
Canal hacia el norte Plan: Canal mejorado 100
.05
.035
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Ground
Bank Sta
Elevation (m)
Station (m)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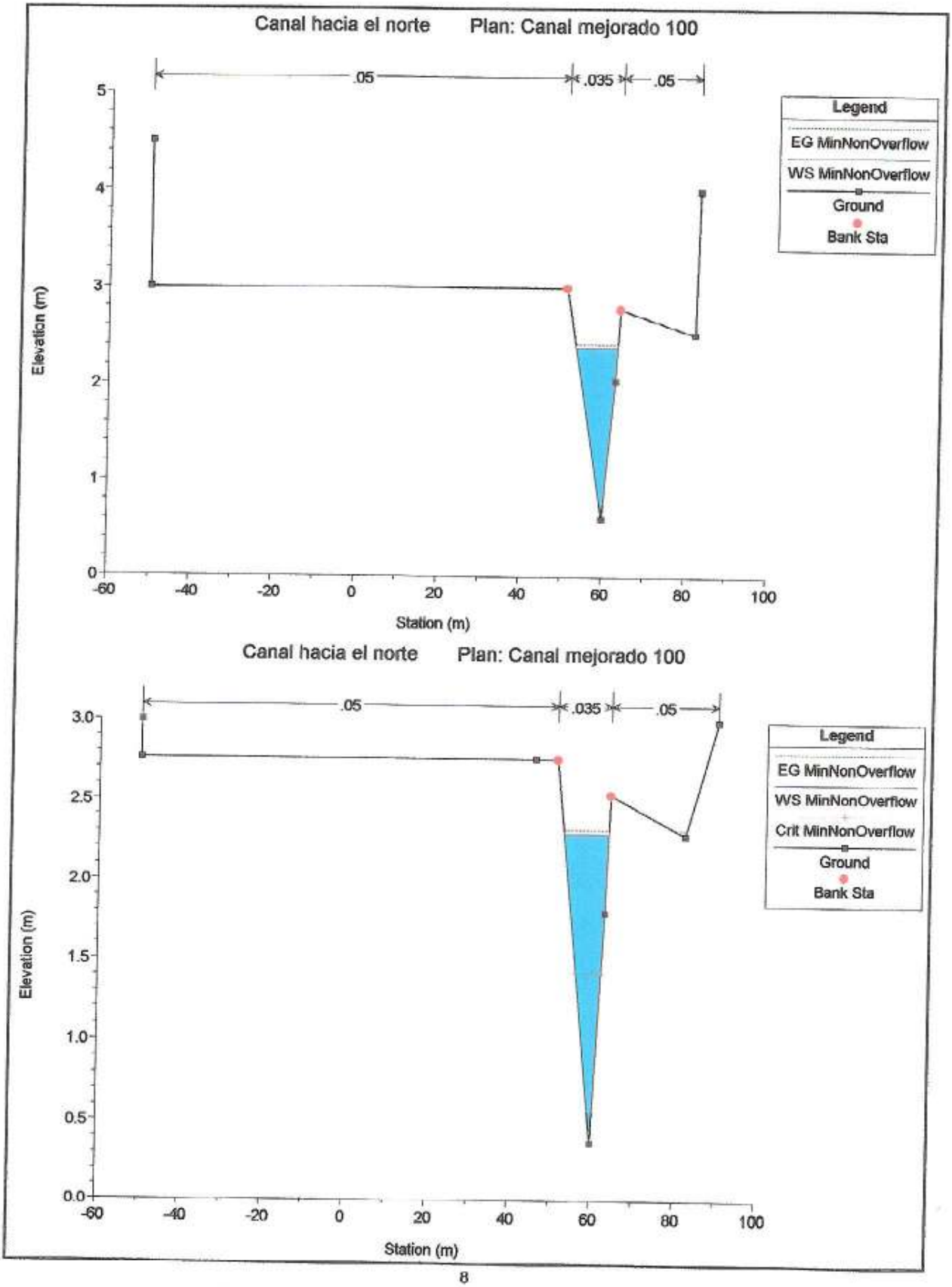
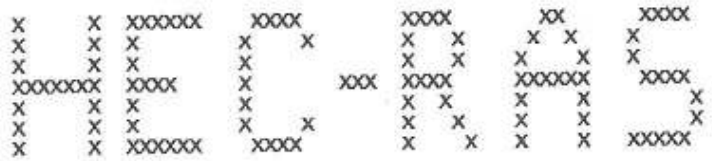
.05
.035
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Ground
Bank Sta
Elevation (m)
Station (m)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-60
-40
-20
0
20
40
60
80
100
Canal hacia el norte Plan: Canal mejorado 100
.05
.035
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Ground
Bank Sta
Elevation (m)
Station (m)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-60
-40
-20
0
20
40
60
80
100


Canal hacia el norte
Plan: Canal mejorado 100
.05
.035
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Ground
Bank Sta
Elevation (m)
Station (m)
Canal hacia el norte
Plan: Canal mejorado 100
.05
.035
.05
Legend
EG MinNonOverflow
WS MinNonOverflow
Crit MinNonOverflow
Ground
Bank Sta
Elevation (m)
Station (m)

HEC-RAS Version 3.0.1 Mar 2001
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104



PROJECT DATA
Project Title: Atarjea Quebrada Boquilla Extendido
Project File : QBoquillaExtendido.prj
Run Date and Time: 12/29/2002 12:33:11 AM

Project in SI units

Project Description:
Sistema de Canales que descargan en los terrenos adyacentes a Elite Valley

PLAN DATA

Plan Title: Atarjea Existente + Nueva
Plan File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Atarjea Q Boquilla Extendido\QBoquillaExtendido.p04

Geometry Title: Atarjea Boquilla Completa
Geometry File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Atarjea Q Boquilla Extendido\QBoquillaExtendido.g05

Flow Title : Q100
Flow File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Atarjea Q Boquilla Extendido\QBoquillaExtendido.f01

Plan Description:
Atarjea para Quebrada Boquilla que cruza PR-2 en el sur del proyecto. Condicion propuesta con extension de 122 metros.

Plan Summary Information:

Number of:	Cross Sections	= 8	Mulitple Openings	=	0
	Culverts	= 1	Inline Weirs	=	0
	Bridges	= 0			

Computational Information
Water surface calculation tolerance = 0.0001
Critical depth calculaton tolerance = 0.0001
Maximum number of interations = 40
Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Q100
Flow File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Atarjea Q Boquilla Extendido\QBoquillaExtendido.f01

Flow Data (m3/s)

River	Reach	RS	Q 100	Low Flow
Q. Boquilla Exis	Atarjea PR-2	5	65	4.05
Q. Boquilla Exis	Atarjea PR-2	3	65	4.05
Q. Boquilla Exis	Atarjea PR-2	2	65	4.05

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Q. Boquilla Exis	Atarjea PR-2	Q 100		Known WS = 3.5
Q. Boquilla Exis	Atarjea PR-2	Low Flow		Known WS = 2.95

GEOMETRY DATA

Geometry Title: Atarjea Boquilla Completa
Geometry File : c:\DOCUME~1\WALTER~1.SIL\My Documents\My Office\Consulting\El Mani Plaza\Elite Valley\EliteValley\Suplemento\Modelos\HEC-RAS\Atarjea Q Boquilla Extendido\QBoquillaExtendido.g05

CROSS SECTION RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2 RS: 5

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2.86	16.98	2.85	28.53	2.8	51.13	2.82	53.99	2.46
55.62	2.75	72.08	4.04	74.05	3.61	86.19	3.37	95.98	3.49
108.03	3.51	113.33	3.52	124.45	3.6				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	51.13	.03	55.62	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
51.13	55.62	86	86	.1	.3

CROSS SECTION RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2 RS: 4

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	3.11	5.9	3	14.51	2.97	25.11	2.3	40.29	2.02
46.21	1.93	48.18	1.77	52.16	2.03	54.01	3.56	60.82	3.45
68.11	3.27	74.34	3.23	80.04	3.08	97.02	3.52		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	46.21	.03	52.16	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46.21	52.16	73	73	.1	.3

CROSS SECTION RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2 RS: 3

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4.76	7.49	4.37	19.52	3.49	19.87	4.08	34.17	3.63
48.8	3.79	52.15	1.79	54.21	1.21	56.84	1.61	59.91	1.7
60.89	2.03	61.88	2.86	63.55	4.35	65.95	4.45	80.54	4.49
97.25	4.47	117.59	4.2	135.9	3.96				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	48.8	.03	65.95	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
48.8	65.95	42	42	.1	.3

CULVERT RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2 RS: 2.5

INPUT
Description: Atarjea PR-2
Distance from Upstream XS = 1
Deck/Roadway Width = 40
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates

num=	3						
Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord		
0	4.22	0	65	4.22	0	169	4.84	0

Upstream Bridge Cross Section Data

Station Elevation Data	num=	18							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4.76	7.49	4.37	19.52	3.49	19.87	4.08	34.17	3.63
48.8	3.79	50.84	1.03	54.21	1.03	56.84	1.21	59.91	1.7
60.89	2.03	61.88	2.86	63.55	4.35	65.95	4.45	80.54	4.49
97.25	4.47	117.59	4.2	135.9	3.96				

Manning's n Values	num=	3		
Sta	n Val	Sta	n Val	Sta	n Val
0	.035	48.8	.03	65.95	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
48.8	65.95	.1	.3

Downstream Deck/Roadway Coordinates

num=	3						
Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord		
0	4.22	0	80	4.22	0	164	4.84	0

Downstream Bridge Cross Section Data

Station Elevation Data	num=	21							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4.63	5.09	5.33	5.36	5.46	14.88	5.06	15.86	4.97
25.37	4.1	39.19	3.63	42.85	2.34	43.9	2.62	45	1.77
46	.77	49.17	.77	52	.77	54.94	1.62	65.55	2.15
71.66	3.33	76.84	3.72	87.87	3.21	100.39	3.33	114.92	3.46
122.43	3.68								

Manning's n Values	num=	3		
Sta	n Val	Sta	n Val	Sta	n Val
0	.03	39.19	.035	76.84	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
45	54.94	.1	.3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	3	2.95

FHWA Chart # 57- Rectangular
FHWA Scale # 1 - Tapered inlet throat
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	n Value	Entrance Loss Coef	Exit Loss Coef
1	40	.013	.5	1

Number of Barrels = 2
Upstream Elevation = 1.034
Centerline Stations

Sta.	Sta.
52.71	55.71

Downstream Elevation = 0.773
Centerline Stations

Sta.	Sta.
47.67	50.67

CROSS SECTION RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2 RS: 2

```
INPUT
Description:
Station Elevation Data    num=       7
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
        0     3.76     44.7     3.76       45     3.76       45      .53       53      .53
       53     3.76      110     3.76

Manning's n Values        num=       3
      Sta   n Val       Sta   n Val       Sta   n Val
        0    .014        45    .014        53    .014

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            45      53                    30        30       30             .1      .3
Cross Section Lid
    num=       2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
    44.7    3.76    3.56     53.3    3.76    3.56

CROSS SECTION                RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2          RS: 1.8

INPUT
Description:
Station Elevation Data    num=       6
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     44.7     3.76       45     3.76       45     .439       53     .439       53     3.76
     53.3     3.76

Manning's n Values        num=       3
      Sta   n Val       Sta   n Val       Sta   n Val
     44.7    .013        45    .014        53    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            45      53                    30        30       30             .1      .3
Cross Section Lid
    num=       2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
    44.7    3.76    3.56     53.3    3.76    3.56

CROSS SECTION                RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2          RS: 1.6

INPUT
Description:
Station Elevation Data    num=       6
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     44.7     3.76       45     3.76       45     .348       53     .348       53     3.76
     53.3     3.76

Manning's n Values        num=       3
      Sta   n Val       Sta   n Val       Sta   n Val
     44.7    .013        45    .014        53    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            45      53                    30        30       30             .1      .3
Cross Section Lid
    num=       2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
    44.7    3.76    3.56     53.3    3.76    3.56

CROSS SECTION                RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2          RS: 1.4

INPUT
Description:
Station Elevation Data    num=       6
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     44.7     3.76       45     3.76       45     .257       53     .257       53     3.76
     53.3     3.76

Manning's n Values        num=       3
      Sta   n Val       Sta   n Val       Sta   n Val
     44.7    .013        45    .014        53    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            45      53                    32        32       32             .1      .3
Cross Section Lid
    num=       2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
```

44.7	3.76	3.56	53.3	3.76	3.56

CROSS SECTION RIVER: Q. Boquilla Exis
REACH: Atarjea PR-2 RS: 1.

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
44.7	3.76	45	3.76	45	.16	53	.16	53	3.76
53.3	3.76								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
44.7	.013	45	.014	53	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
45	53	30	30	.1	.3

Cross Section Lid
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
44.7	3.76	3.56	53.3	3.76	3.56

SUMMARY OF MANNING'S N VALUES

River:Q. Boquilla Exis

Reach	River Sta.	n1	n2	n3
Atarjea PR-2	5	.035	.03	.035
Atarjea PR-2	4	.035	.03	.035
Atarjea PR-2	3	.035	.03	.035
Atarjea PR-2	2.5	Culvert		
Atarjea PR-2	2	.014	.014	.014
Atarjea PR-2	1.8	.013	.014	.013
Atarjea PR-2	1.6	.013	.014	.013
Atarjea PR-2	1.4	.013	.014	.013
Atarjea PR-2	1.	.013	.014	.013

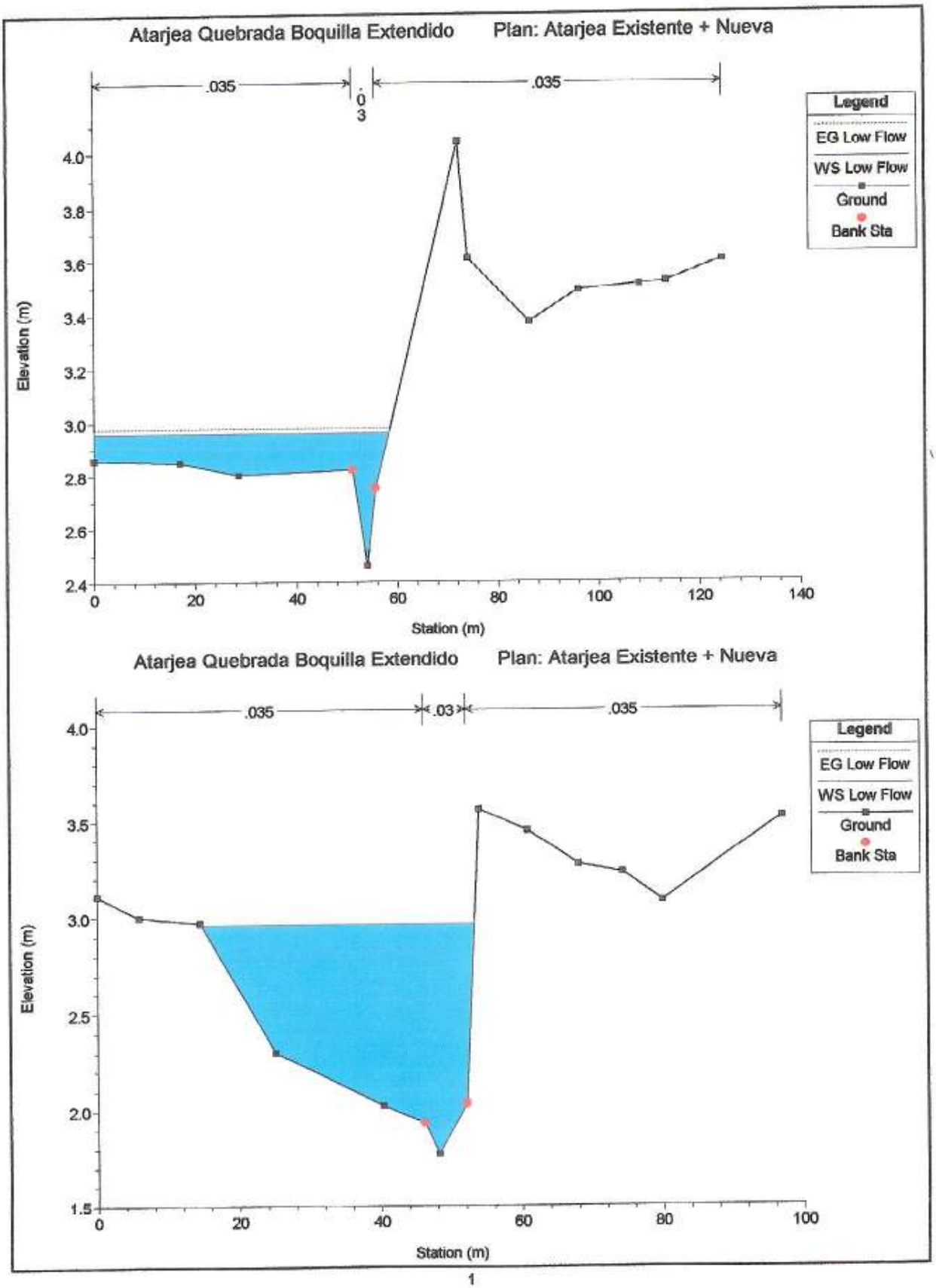
SUMMARY OF REACH LENGTHS

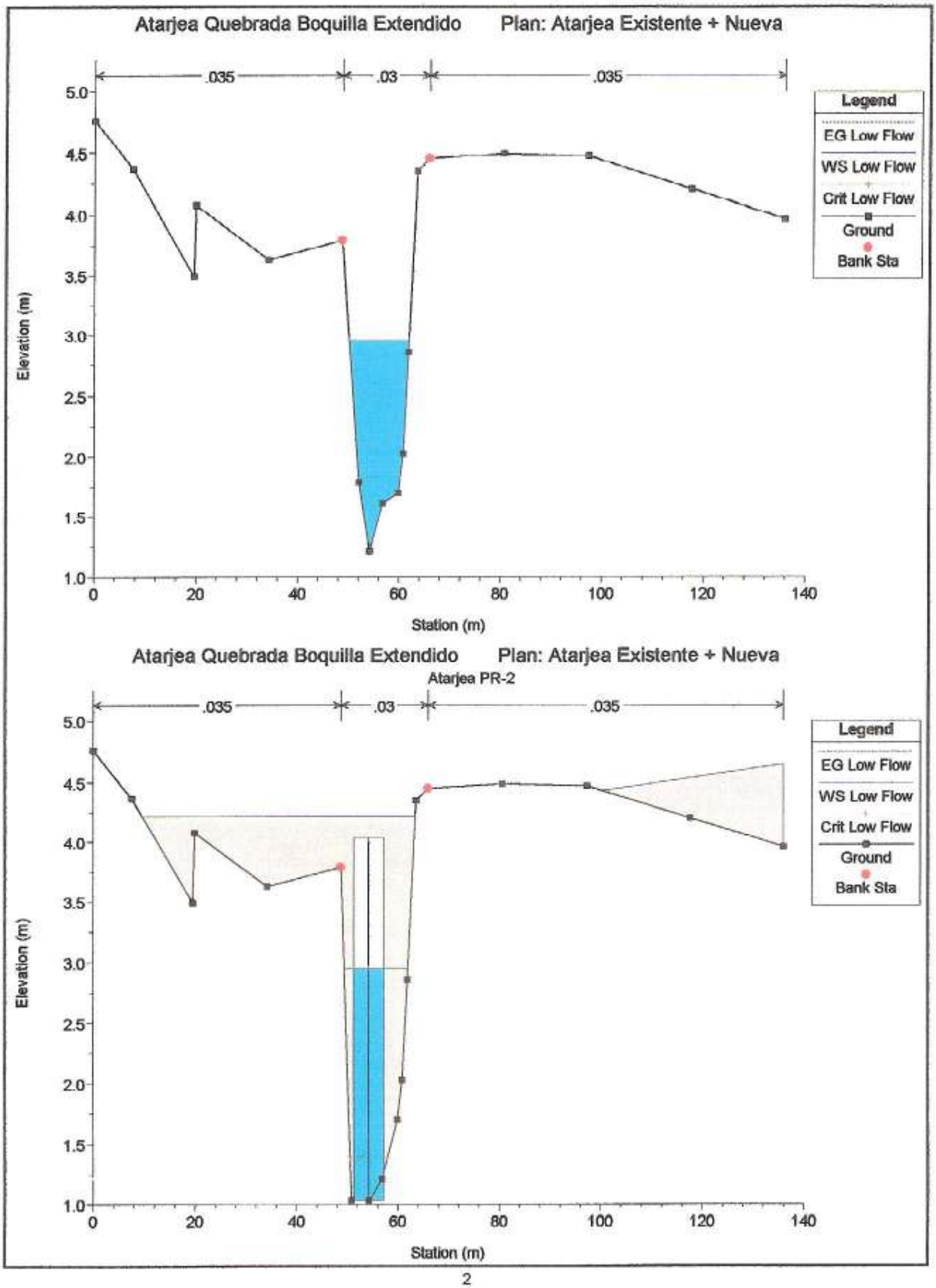
River: Q. Boquilla Exis

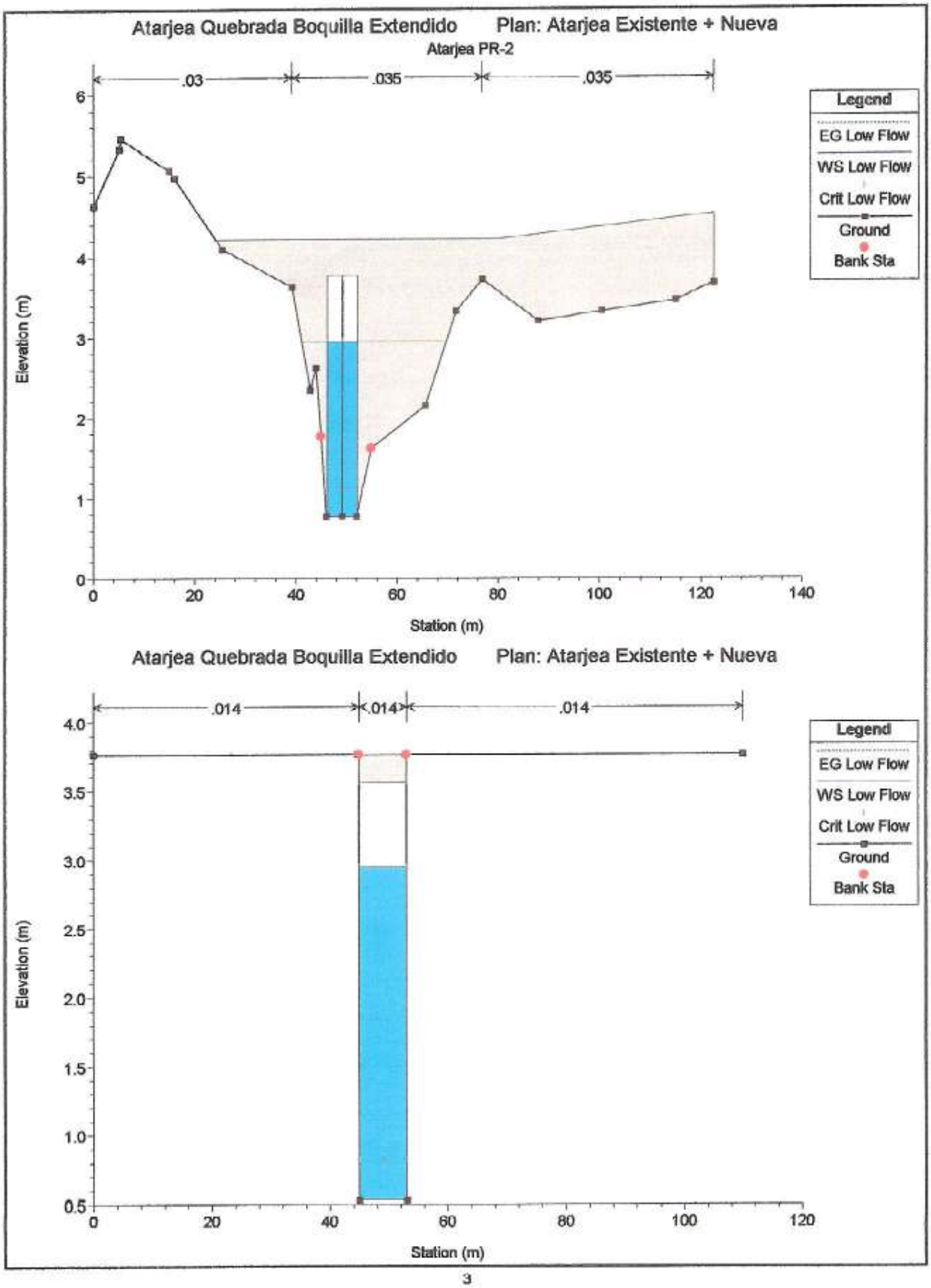
Reach	River Sta.	Left	Channel	Right
Atarjea PR-2	5	86	86	86
Atarjea PR-2	4	73	73	73
Atarjea PR-2	3	42	42	42
Atarjea PR-2	2.5	Culvert		
Atarjea PR-2	2	30	30	30
Atarjea PR-2	1.8	30	30	30
Atarjea PR-2	1.6	30	30	30
Atarjea PR-2	1.4	32	32	32
Atarjea PR-2	1.	30	30	30

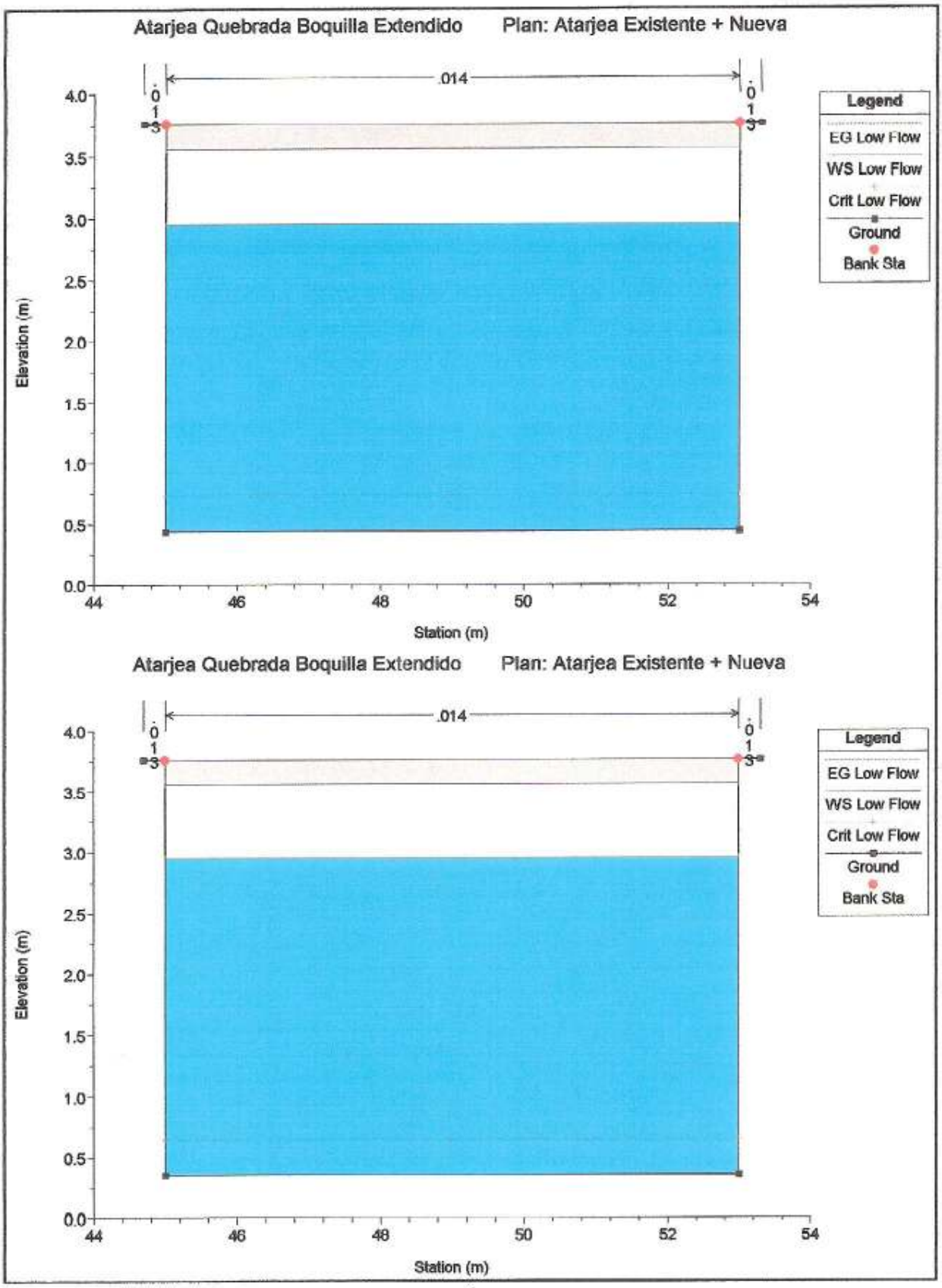
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Q. Boquilla Exis

Reach	River Sta.	Contr.	Expan.
Atarjea PR-2	5	.1	.3
Atarjea PR-2	4	.1	.3
Atarjea PR-2	3	.1	.3
Atarjea PR-2	2.5	Culvert	
Atarjea PR-2	2	.1	.3
Atarjea PR-2	1.8	.1	.3
Atarjea PR-2	1.6	.1	.3
Atarjea PR-2	1.4	.1	.3
Atarjea PR-2	1.	.1	.3


Atarjea Quebrada Boquilla Extendido
Plan: Atarjea Existente + Nueva
.035
.03
.035
Legend
EG Low Flow
WS Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)
Atarjea Quebrada Boquilla Extendido
Plan: Atarjea Existente + Nueva
.035
.03
.035
Legend
EG Low Flow
WS Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)


Atarjea Quebrada Boquilla Extendido Plan: Atarjea Existente + Nueva
.035
.03
.035
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)
Atarjea Quebrada Boquilla Extendido Plan: Atarjea Existente + Nueva
Atarjea PR-2
.035
.03
.035
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)


Atarjea Quebrada Boquilla Extendido Plan: Atarjea Existente + Nueva
Atarjea PR-2
.03
.035
.035
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)
Atarjea Quebrada Boquilla Extendido Plan: Atarjea Existente + Nueva
.014
.014
.014
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)


Atarjea Quebrada Boquilla Extendido
Plan: Atarjea Existente + Nueva
.014
.013
.013
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
44
46
48
50
52
54
Atarjea Quebrada Boquilla Extendido
Plan: Atarjea Existente + Nueva
.014
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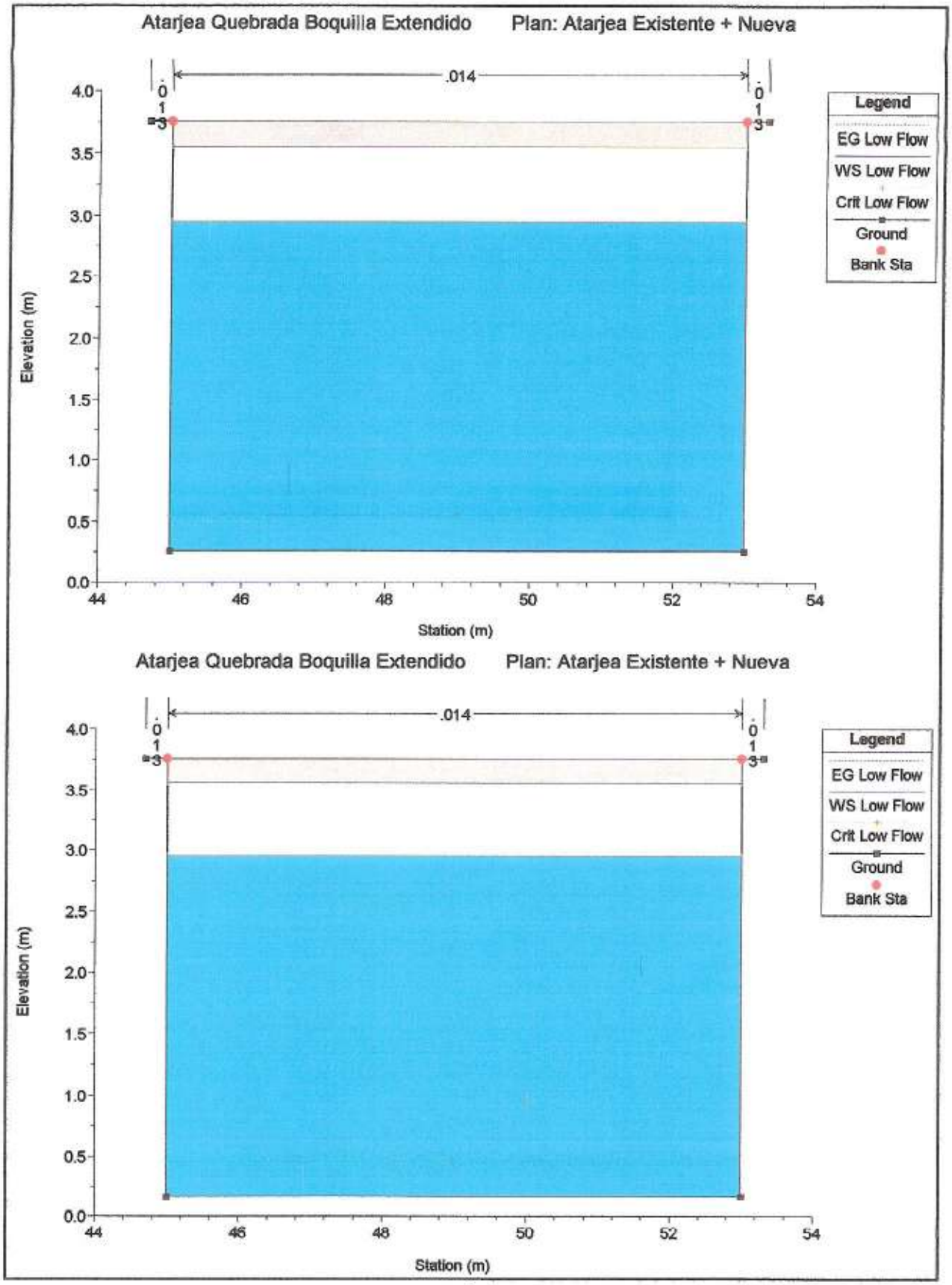
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)


Atarjea Quebrada Boquilla Extendido Plan: Atarjea Existente + Nueva
.014
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Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)
4.0
3.5
3.0
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2.0
1.5
1.0
0.5
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44
46
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Atarjea Quebrada Boquilla Extendido Plan: Atarjea Existente + Nueva
.014
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.013
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (m)
Station (m)