

**REVISED SUMMARY DRAINAGE STUDY
for the
SOUTH OF CHANNEL WATERSHED
of the
MISSION BAY PROJECT**

including

**Overland Flow Analysis
Separated Storm Drain Analysis
and
Supplementary Calculations**

Prepared for:



CATELLUS

DECEMBER 1, 2000

INDEX

REVISED SUMMARY DRAINAGE STUDY

FORWARD

I.	INTRODUCTION	i.
	Boundaries	i.
II.	CONCEPTUAL GRADING PLAN	ii.
III.	ANALYSIS	ii.
	Overland Flow	ii.
	Iterative Overland Flow Calculations	iii.
	Typical Backwater Curve Effect	iv.
	Ponding at Third Street and South Common Street	iv.
	Separated Storm Drain System	iv.
	Tides	v.
IV.	THIRD STREET DEPRESSION	v.
	Figure 1: Supplemental Storm Drain System	
V.	OVERLAND RELEASE	vi.
	Weir Analysis at Overland Release Point	vi.
VI.	SUMMARY	vi.

CALCULATIONS

OVERLAND FLOW ANALYSIS - Initial Grades (12/01/00)

OVERLAND FLOW ANALYSIS - Final Grades (12/01/00)

SEPARATED STORM DRAIN ANALYSIS (2/11/00)

ITERATIVE OVERLAND FLOW CALCULATIONS (3/15/00)

Basin 4 – Steepest Slopes
Basin 2 – Flattest Slopes

MISSION BAY PROJECT
Catellus Development Corp.

BACKWATER CURVE (HGL) FOR OVERLAND FLOW (3/15/00)

Basin 4 – Initial Grades

WATER SURFACE PROFILE ON OVERLAND RELEASE ROUTE (12/01/00)

Basin 1 – Third St.– North/South Common St. – Terry François Blvd.

WEIR ANALYSIS AT OVERLAND RELEASE POINT (12/01/00)

Basin 1 – Terry François Blvd. and South Common St.

WEIR ANALYSIS AT OVERLAND RELEASE POINT (4/26/00)

Basin 5 – Round About

PLANS

CONCEPTUAL GRADING PLAN (12/01/00)

WATERSHED MAP FOR OVERLAND FLOW - Initial Grades (12/01/00)

WATERSHED MAP FOR OVERLAND FLOW - Final Grades (12/01/00)

SEPARATED STORM DRAIN SYSTEM (12/01/00)

FORWARD

On February 11, 2000, a Drainage Study for the South of Channel Watershed of the Mission Bay Project was prepared for the Catellus Development Corporation. The study included an Overland Flow Analysis and Separated Storm Drain Analysis. These analyses were based on the Conceptual Grading Plan, Watershed Maps for Overland Flow for Initial and Final grades, and the Separated Storm Drain System map, which were current at that time. Subsequent review and discussion with the San Francisco Public Utilities Commission resulted in the development of Supplemental Data submitted to the Commission on March 15, 2000 and again on April 26, 2000. With each submission of supplemental data, the four supporting plans and the drainage study were modified and refined. On June 2, 2000 a "Summary Drainage Study" was prepared to reflect modifications and refinements made since the original publication of the study.

In September 2000, it was learned that the Potter Electric building, situated on the east side of Third Street between Rincon Street and North Common Street, would not be acquired by the Mission Bay Project and would therefore remain at its present elevation. This necessitated further modification to the Conceptual Grading Plan and an enlargement of the "Third Street depression" to include the existing building. At the request of the City of San Francisco Public Utilities Commission, the Summary Drainage Study dated June 2, 2000, has been revised to reflect this change.

This Revised Summary Drainage Report includes a revised Overland Flow Analysis, for both initial and final grading conditions. Additionally, the "Water Surface Profile on Overland Release Route" and the "Weir Analysis at Overland Release Point – Terry François Blvd.", which are affected by the grade changes on Third Street, have also been updated. Even though the profile of Third Street has changed, the profile of the underground storm drain system has not. Thus the Separated Storm Drain System map required no modification. The supporting hydraulic calculations are largely unaffected and retain their original date of February 11, 2000. The one exception, however, is the calculation of freeboard (the difference between the street grade and the hydraulic grade line). While the lowering of Third Street reduces the available freeboard, in no case is freeboard reduced below the minimum requirement established by the Mission Bay Subdivision Regulations. Supplementary calculations remain in their original form and retain their original dates of March 15, and April 26, 2000.

Finally, the revised Conceptual Grading Plan, Watershed Maps for Overland Flow for Initial and Final grades, dated December 1, 2000, are included herein. The Separated Storm Drain System map has also been re-dated to December 1, 2000 for consistency with this Revised Summary Drainage Study, and to establish it as the current version, but it is otherwise unchanged.

I. INTRODUCTION

The purpose of this study is to evaluate drainage patterns for the south of channel watershed of the Mission Bay project, and to develop a conceptual drainage plan to provide guidance for the future development of the watershed. The conceptual drainage plan consists of a conceptual grading plan for the watershed, an overland release strategy, and a conceptual system map for the proposed separated storm drain system.

Boundaries

The south of channel watershed is bounded to the north by the China Basin Channel, to the west by State Highway 280, to the south by Mariposa Street, and to the east by the San Francisco Bay.

The area of State Highway 280 has been excluded from the watershed as Cal Trans "as-built" drawings indicate that run-off collected in the elevated freeway is either conveyed to pipe systems outside the south of channel watershed, or discharged directly to the China Basin Channel. Relevant Cal Trans drawings include Sheet D-1 (sheet 31 of 454) Contract #133171, Sheet D-2 (sheet 32 of 454) Contract #133171, and Sheet D-1 (sheet 24 of 191) Contract #280011.

On February 14, 2000, dye tests were conducted which confirmed that freeway storm drainage is conveyed to the City pipe system outside the south of channel watershed.

II. CONCEPTUAL GRADING PLAN

A conceptual grading plan has been developed to establish appropriate drainage patterns throughout the south of channel watershed. Complicating this process is the expected non-uniform settlement of the watershed due to the consolidation of underlying soils. The degree of settlement is dependant upon the amount of cut or fill proposed, and the specific location on the site. As a result, the grading plan contains both grades proposed after 50 years of settlement (final), and the initial design grades needed to achieve them. The relationship between existing, initial, and final grades has been established through geotechnical testing and analysis performed by Treadwell & Rollo Inc.

Thus the *Conceptual Grading Plan* prepared by Santina & Thompson Inc. and Hawk Engineers, Inc. dated December 1, 2000, consists of two distinct but inter-dependant grading plans, each of which is designed to provide overland release of accumulated (100 year storm frequency) run-off when the capacity of the underground storm drain system (5 year storm frequency) is exceeded. It should also be noted that expected site settlement will result in a reversal of flow direction between the initial grading and final settlement grades in some areas. These areas are highlighted on the *Conceptual Grading Plan*.

III. ANALYSIS

Section XVIII "Required Capacity of Separated Storm Drain System" of the *Mission Bay Subdivision Regulations* requires that...

Storm water drains shall have sufficient capacity, when flowing full or surcharged, to carry the computed storm water run-off, based on the ultimate development of the area, including the natural drainage from upstream areas. Flows for a storm frequency of up to five years will be carried in pipes. Storms of a frequency greater than five years will be carried in the street as overland flow.

The following two analyses were performed to establish compliance with these requirements.

Overland Flow

As required by the *Mission Bay Subdivision Regulations*, excess run-off generated by storms exceeding the design capacity (5 year storm frequency) of the underground piping system, must be conveyed in the streets as overland flow. Overland flows (100 years), must be contained within the street right-of-way to avoid property damage. For this reason the *Conceptual Grading Plan* was designed to direct excess drainage to one of five release points, three on the China Basin Channel, and two on the San Francisco Bay. The purpose of the overland flow analysis is to determine whether or not overland flow can be contained within the street right-of-way..

Because there are two distinct grading plans (one based on initial pre-settlement grades and the other based on final 50 year settlement grades) separate analyses had to be performed on each.

As an initial step, a watershed map for each grading plan was prepared indicating the direction of flow and the areas tributary to each release point. These drawings are entitled *Watershed Map for Overland Flow based on Initial (Pre-Settlement) Grades, and Watershed Map for Overland Flow based on Final (50 Year Settlement) Grades*. Based on this analysis, overland flows during the 100 year design storm were quantified at critical street locations such as Third Street, Terry Francois Boulevard, Sixteenth Street, Owens Street, and the Commons. All run-off calculations were performed using the "Rational Method" as prescribed by the Mission Bay Subdivision Regulations. Time of concentration was computed as the sum of the time required to reach the gutter (3 minutes) and the gutter travel time (length/velocity) based on a velocity of 1.5 fps.

Finally, open channel flow calculations were performed to determine the depth of flow based on the street geometry contained in the *South of Channel Infrastructure Plan* prepared by KCA Engineers, Inc. in September 1998. The resulting calculations (*Overland Flow Analysis – Initial Grades* dated December 1, 2000 and *Overland Flow Analysis – Final Grades* dated December 1, 2000) indicate that proposed street rights-of-way have sufficient capacity to convey excess run-off, during the 100 year storm event, to the appropriate downstream release point.

It should be noted that overland flow will accumulate at release points until the curb height is overcome and release to the Channel or Bay is accomplished. Ponding areas shown on the *Watershed Maps for Overland Flow* are based upon run-off accumulating to a 6 inch depth (curb height) based solely on the topographic characteristics of the area. In actuality, the size and depth of ponds will vary based on the duration and intensity of the storm and the weir depth over the curb at the release point.

Iterative Overland Flow Calculations

At a meeting with the SFPUC on February 29, 2000, it was suggested that an iterative calculation approach (wherein by successive runs, the velocity used in run-off calculations to determine street flow time, and the velocity resulting from open channel calculations would be identical) would result in more accurate street flow depths.

On March 15, 2000 *Iterative Overland Flow Calculations* were performed such that the velocity ultimately used in the run-off calculations (to determine flow) was identical to the velocity produced by the open channel calculations (to determine the depth of flow in the street). This was done to confirm that the assumed average velocity of 1.5 fps, was in fact conservative as intended. Iterative calculations were performed on two basins only to disclose the effect the iterative process would have on the final result.

Basin 4 (initial grades) was chosen because it has the steepest street slopes, and was the most likely of the 5 basins analyzed in the February 11, 2000 Overland Flow Calculations to result in calculated velocities being greater than the assumed velocity. Basin 2 (initial grades) was also analyzed because it has the flattest street slopes. This was done to disclose the range of effect that the iterative process would have. Each basin was divided into sections representing different street slopes and then subjected to the iterative process. The results confirm that the assumed velocity of 1.5 fps is in fact conservative. The results are summarized as follows:

<u>Basin</u>	<u>Flow per Feb.11 Calcs.</u>	<u>Flow per Mar.15 Iterative Calcs.</u>	<u>Effect</u>
4 (steepest)	25.3 cfs	25.3 cfs	unchanged
2 (flattest)	11.0 cfs	7.8 cfs	reduced 29%

Typical Backwater Curve Effect

The determination of street flow depth, contained in the February 11, 2000 open channel calculations, was based upon a normal flow analysis. At the February 29, 2000 meeting with the SFPUC, it was suggested that a typical backwater curve analysis should be performed to determine whether or not the backwater effect would be significant. Owens Street (Basin 4) flowing towards the release point and ponding at the Round About (based on initial grades) was used because it has the flattest slope and would reveal the greatest backwater effect. A HEC-RAS model was prepared to determine the backwater curve from the Round About upstream to Owens Street. The calculations demonstrate that the increase in flow depth varies from 0.06 feet to 0.02 feet and is limited to a 100 foot section. Because this area represents the worst case scenario, it can be concluded that the increase in water depth due to the backwater effect will be insignificant within the project site.

Ponding at Third Street and South Common Street

A hydraulic analysis was performed to determine the water surface profile for overland flow routed through the depression at Third Street and South Common Street under initial grading conditions. South Common Street contains a highpoint (between Third Street and Terry François Boulevard) at its intersection with the midpoint connector road under initial grading conditions to assure that the final (50 year settlement) elevations remain at or above the design high tide. It is this highpoint which creates the potential for ponding at Third Street and South Common Street.

To prevent this ponding, a drainage swale, adjacent to the north side of South Common Street, has been utilized to convey overland flow to the release point at Terry François Boulevard, without the need to cross the high point in the roadway. The high point on Third Street, between Rincon Street and North Common Street, is intended to prevent any backflow from Third and South Common Streets to the depression at Third and Rincon Streets (See *Third Street Depression* below). Further, to generally improve the overland flow capacity of Third Street, and North and South Common Streets, the Conceptual Grading Plan requires that 4% sidewalk cross-slopes be used at strategic locations.

The attached HEC-RAS calculations, *Water Surface Profile on Overland Release Route*, indicate a maximum water surface elevation of 99.07 feet at Third and South Common Streets, which can be contained within the right-of-way (back of sidewalk elevation = 99.18 ft.).

Separated Storm Drain System

As stated above, the *Mission Bay Subdivision Regulations* require that the 5 year design storm be carried in the underground storm drain system. The regulations further require that storm drain pipes be sized such that the hydraulic grade line is generally two (2) feet below the pavement or ground surface, but at no point less than one (1) foot below the pavement or ground surface, and that all pipes shall be at least 12 inches in diameter.

A conceptual plan for the separated storm drain system for the watershed, including proposed pipe sizes and profiles, has been developed to meet these requirements. Based on the *Conceptual Grading Plan* and the proposed future development of the watershed, tributary areas for each node of the system have been estimated and are shown on the *Separated Storm Drain System Watershed Map*. With this information and the 5 year rainfall intensity data provided by the San Francisco Public Utilities Commission, the capacity of the storm drain piping system was analyzed.

The Rational Method of analysis was used in conformance with standard practice and the requirements of the *Mission Bay Subdivision Regulations*. This method provides an appropriately

conservative approach to the hydrologic/hydraulic analysis. The calculations on the underground piping network were prepared using state of the art StormCad v3 software developed by Haestad Methods, Inc.

Tides

The south of channel watershed consists of lowlands contiguous to the San Francisco Bay. As such, proposed grades and hydraulic calculations are influenced by the tidal regime of the Bay. The Mission Bay Subdivision Regulations state:

The tidal elevation to be used in hydraulic computations, where applicable, shall be 97.5 feet Mission Bay Datum. The design high tide shall be 98.0 Mission Bay Datum.

The first elevation of 97.5 ft. is intended to establish the tailwater elevation for computation of the hydraulic grade line. For the south of channel watershed, however, each of the five underground piping systems terminate at a pumping facility. Because the terminal end of each pipe system is below the elevation of the Bay, pumping is necessary. As such, the tidal elevation of 97.5 ft. is not relevant to hydraulic grade line calculations. The tailwater elevation (starting HGL) used for these calculations is the critical depth of flow at the inlet to the pump.

The design high tide elevation of 98.0 ft. represents the maximum anticipated height of Bay waters. The potential for the Bay to cause flooding by backflowing into the piping system is therefore of concern. For this reason, the *Conceptual Grading Plan* was prepared so that all proposed top of curb elevations are no lower than 98.0 ft. after 50 years of settlement (final grades). The sole exception being the existing Third Street depression which is discussed below. Additionally, all outlets would be equipped with flap gates to prevent the intrusion of Bay waters into the piping system.

Finally, in order to achieve a minimum of one (1) foot of freeboard above the high tide elevation, the *Conceptual Grading Plan* establishes 99.0 ft. as the minimum first floor elevation for future structures.

IV. THIRD STREET DEPRESSION

The overland flow analysis described above, indicates the presence of a local depression on Third Street between Mission Rock and North Common Streets (Basin 8). Owing to progressive settlement, Third Street has settled to elevations as low as 96.8 ft. Because the existing Firehouse and Potter Electric building, on the east side of Third Street, are to remain, raising of Third Street to the elevations required by the *Mission Bay Subdivision Regulations* is precluded. As a result, the overland release of excess run-off from this area is not possible.

Thus, the potential for flooding at the Firehouse and the Potter Electric building, and the clearance requirements for the MUNI Third Street Light Rail Project, make it necessary to find alternate means to release excess run-off when the 5 year design storm is exceeded. Five possible solutions have been discussed with respect to the Third Street depression, as follows:

1. Allow standard overland release of ponded waters (with incumbent flooding problems for MUNI and adjacent buildings when the 5 year storm is exceeded).
2. Use retaining walls, traffic barriers, and a dedicated pump to protect MUNI facilities and adjacent buildings (mandatory traffic rerouting and additional cost).

3. Provide a supplemental overflow piping system with dedicated pumps and a backup generator, to receive excess run-off up to the 100 year storm event.
4. Raise Third Street above the flood plain and provide sump pumps to drain below grade existing sidewalks and buildings.
5. Raise Third Street above the flood plain and relocate the existing Firehouse and Potter Electric buildings.

Each option was evaluated and Option #3 has been determined to be best solution as it would minimize flooding and access problems while eliminating the need for the raising of Third Street, which could promote additional settlement. Option #3 is shown in *Figure 1: Supplemental Storm Drain System at the Third Street Depression*.

V. OVERLAND RELEASE

As previously established, the *Conceptual Grading Plan* was designed so that excess drainage is directed to one of five release points, three on China Basin Channel, and two on the San Francisco Bay. As indicated above, once the capacity of the underground storm drain system is exceeded, excess run-off will accumulate at each of 5 release points, until it reaches sufficient depth to overtop the adjacent curb, and be released to the China Basin Channel or the San Francisco Bay.

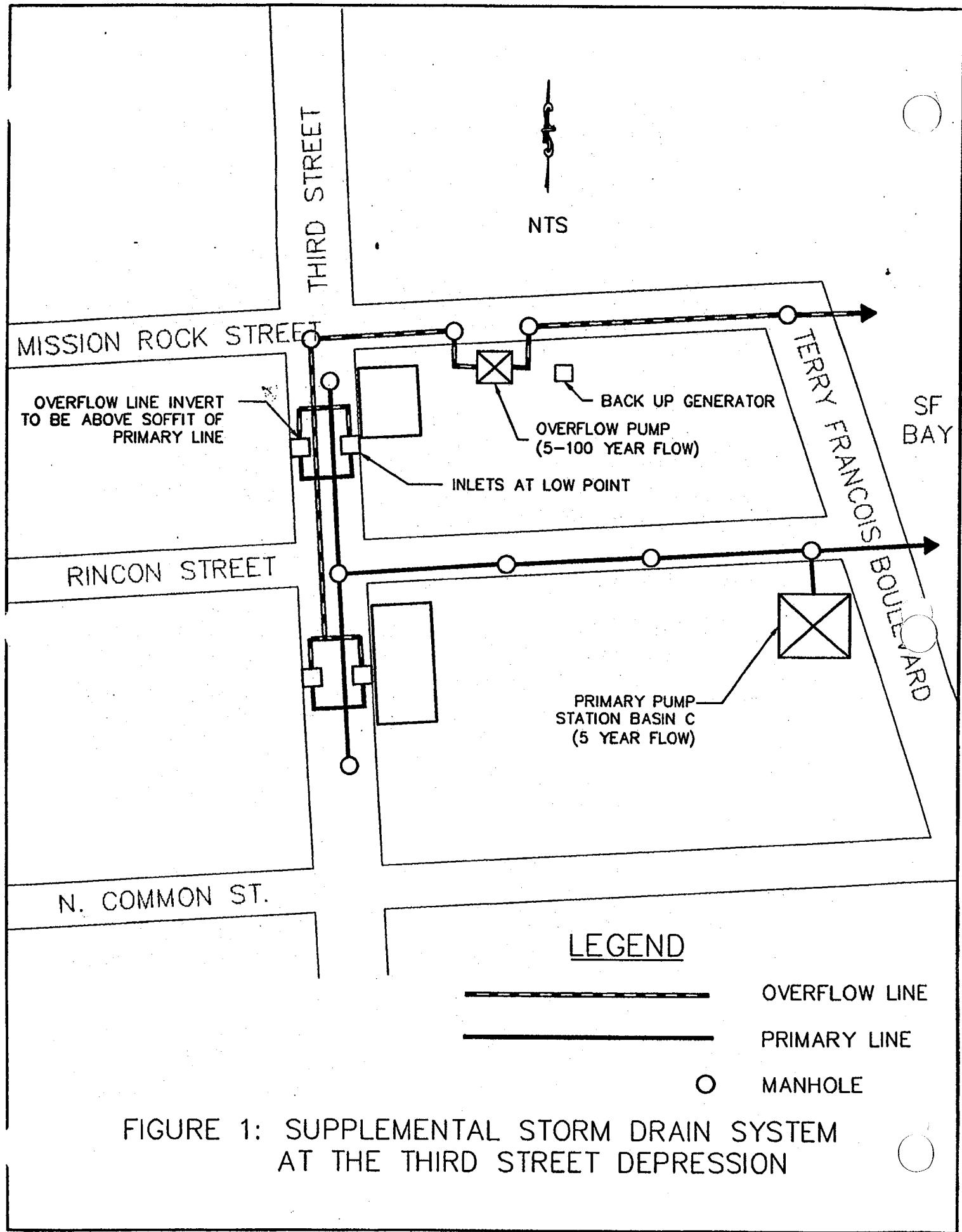
Weir Analysis at Overland Release Point

Weir calculations were prepared for release points at Terry François Boulevard (Basin 1) and at the Round About (Basin 5), to determine the depth of flow over the curbline, in order to confirm that accumulated water could be contained within the right-of-way. The calculations indicate for the Terry François Blvd. release point (Basin 1) that a water surface elevation of 98.3 ft. will be achieved prior to release to the San Francisco Bay under initial grading conditions, and that that elevation will drop to 98.2 ft. under final (50 year settlement) grading conditions, both of which can be contained within the right-of-way. Similarly, at the Round About release point (Basin 5), an elevation of 98.42 ft. will be achieved prior to release to the China Basin Channel, which also can be contained within the right-of-way. A weir coefficient of 2.5 was used for all calculations.

VI. SUMMARY

These analyses demonstrate that the *Conceptual Grading Plan*, and associated overland release strategy, and the *Separated Storm Drain System* model proposed for the Mission Bay project meet all requirements of the *Mission Bay Subdivision Regulations*. They establish that flows generated by the 5 year storm event can be conveyed within the underground storm drain system, and that excess run-off produced by the 100 year storm event can be contained within the street rights-of-way prior to release into the China Basin Channel or the San Francisco Bay.

It should be further noted that these conclusions have been reached using a "static" analysis, which does not account for the beneficial effects of abstraction and storage of run-off within the watershed boundaries. During any rainfall, water is continually being abstracted not only by saturation of exposed soils (percolation), but also by evaporation, and absorption by trees, plants, and rooftops. Once saturation occurs, rainfall begins to collect in natural depressions (depression storage) and more significantly, in the underground piping system (pipe storage). Quantifying this effect in a "dynamic" analysis would demonstrate that the proposed system has a marginally greater capacity than that indicated by the conservative static analysis contained in this study.



OVERLAND FLOW ANALYSIS
for the
MISSION BAY PROJECT

based on:

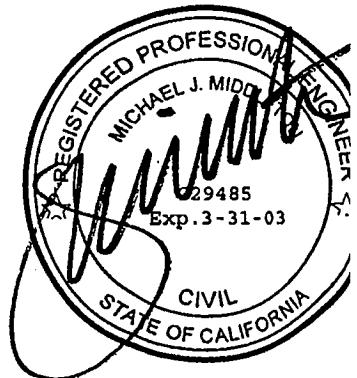
Initial (Pre-Settlement) Grades
and
Final (50 Year Settlement) Grades

Prepared for :



CATELLUS

DECEMBER 1, 2000



INITIAL (PRE-SETTLEMENT)GRADES

Given: Run-off generated by the 5 year design storm, and only run-off generated by the 5 year design storm, will be carried away by the underground storm drain system.

Find: The depth of flow in surface streets generated by excess run-off during the 100 year storm event.

Watersheds: Watersheds are based on initial (pre-settlement) grades, as established on the *Conceptual Grading Plan* prepared by Santina & Thompson Inc. and Hawk Engineers Inc. dated December 1, 2000. The *Watershed Map for Overland Flow based on Initial (Pre-Settlement) Grades* dated December 1, 2000 indicates the proposed drainage basins, direction of flow, drainage areas, and street slopes, used in these calculations. Basin numbers referenced below refer to the Watershed Map.

Standards: All calculations are in accordance with Section XVIII "Required Capacity of Separated Storm Drain System" of the *Mission Bay Subdivision Regulations* dated 1998.

Calculations: All run-off calculations have been performed using the "Rational Method".

Intensities: 5 Year rainfall intensities are taken from the tabulation entitled "San Francisco Rainfall Rate Table 1941" Plan L-3903.4, dated February 1941, and subsequent revisions, as required by the above document. 100 Year rainfall intensities are from the California State Department of Water Resources (CSDWR), developed by Jim Goodridge using Federal Rainfall records in San Francisco. Provided by Leah Orloff of the San Francisco Public Utilities Commission.

Time (minutes)	Intensity 100 Year	Intensity 5 Year	Intensity 100-5 Year
5	4.800	3.126	1.674
6	4.390	2.922	1.468
7	4.240	2.742	1.498
10	3.420	2.316	1.104
15	2.800	1.840	0.960
20	2.370	1.526	0.844
25	2.090	1.303	0.787
30	1.800	1.137	0.663
35	1.730	1.009	0.721
40	1.600	0.918	0.682
45	1.500	0.856	0.644
50	1.420	0.805	0.615
55	1.340	0.762	0.578
60	1.280	0.723	0.557
65	1.230	0.690	0.540
70	1.180	0.661	0.519
75	1.130	0.635	0.495
80	1.100	0.611	0.489
85	1.060	0.590	0.470
90	1.030	0.570	0.460

Coefficient: Table 1 "Coefficients of Run-Off And Inlet Times" contained in the Mission Bay Subdivision Regulations requires a coefficient of 0.80 to 0.96 for "commercial" areas. A coefficient of 0.85 has been selected based on the future development of the area. A coefficient of 0.80 has been used in watersheds containing park land (east of Terry François Blvd. and between North and South Common).

Hydrology (Quantify Flows)

BASIN #1 TERRY FRANÇOIS BOULEVARD (south of 13th Street)

$$Q = C \times I \times A$$

C = 0.80 (Commercial area with some park land.)

Time of Concentration

- Assume time to street equals 3 minutes. (SF Standards require 5 minutes to the first inlet. Time to the curb would be somewhat less and is estimated to be 3 minutes.)
- Street travel time is calculated at 1.5 fps velocity (flat slopes).

$$t_c = 3 \text{ min.} + 1750 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 22 \text{ min.}$$

$$I_{100-s} = 0.821 \text{ at } 22 \text{ min.}$$

Subarea A is tributary.

$$A_{1A} = 24.95 \text{ acres}$$

$$Q_{1A} = (0.80)(0.821)(24.95)$$

$$Q_{1A} = 16.4 \text{ CFS}$$

BASIN #1 THIRD STREET (south of 13th Street)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 1850 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 23 \text{ min.}$$

$$I_{100-s} = 0.810 \text{ at } 23 \text{ min.}$$

Subarea B is tributary.

$$A_{1B} = 17.53 \text{ acres}$$

$$Q_{1B} = (0.85)(0.810)(17.53)$$

$$Q_{1B} = 12.1 \text{ CFS}$$

BASIN #1 NORTH/SOUTH COMMON STREET (Between Third St. and Terry Fran ois Blvd.)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 2700 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 33 \text{ min.}$$

$$I_{100-5} = 0.698 \text{ at 33 min.}$$

Subareas B and C are tributary.

$$A_{1BC} = A_{1B} + A_{1C} = 17.53 + 11.59 = 29.12 \text{ acres}$$

$$Q_{1BC} = (0.85)(0.698)(29.12)$$

$$Q_{1BC} = 17.3 \text{ CFS}$$

BASIN #1 TERRY FRAN OIS BOULEVARD (at low point at South Common)

$$Q = C \times I \times A$$

C = 0.80 (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 3100 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 37 \text{ min.}$$

$$I_{100-5} = 0.705 \text{ at 37 min.}$$

$$A_1 = A_{1A} + A_{1B} + A_{1C} + A_{1D} = 24.95 + 17.53 + 11.60 + 15.02 = 69.10 \text{ acres}$$

$$Q_1 = (0.80)(0.705)(69.10)$$

$$Q_1 = 39.0 \text{ CFS}$$

BASIN #2 **ILLINOIS STREET (north of Mariposa Street)**

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 850 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 12 \text{ min.}$$

$$I_{100-5} = 1.046 \text{ at } 12 \text{ min.}$$

Subarea A is tributary.

$$A_{2A} = 4.86 \text{ acres}$$

$$Q_{2A} = (0.85)(1.046)(4.86)$$

$$Q_{2A} = 4.3 \text{ CFS}$$

BASIN #2 **TERRY FRANÇOIS BOULEVARD (at low point north of Mariposa Street)**

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 1600 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 20 \text{ min.}$$

$$I_{100-5} = 0.844 \text{ at } 20 \text{ min.}$$

$$A_2 = A_{2A} + A_{2B} = 4.86 + 10.49 = 15.35 \text{ acres}$$

$$Q_2 = (0.85)(0.844)(15.35)$$

$$Q_2 = 11.0 \text{ CFS}$$

BASIN #3 NORTH/SOUTH COMMON STREET (at Sixth Street)

The routing of overland flow in Basin #3 will vary depending on the specifics of the final grading and the underground piping for South and North Common Streets. The maximum street depth that can occur, however, is in the case where the maximum amount of run-off is assumed to accumulate at the low end of South Common Street, and is not divided between South and North Common Street. The following analysis assumes full loading of South Common Street alone.

$$Q = C \times I \times A$$

$C = 0.80$ (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 1900 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 24 \text{ min.}$$

$$I_{100-5} = 0.798 \text{ at } 24 \text{ min.}$$

Subareas A, B, and C are tributary.

$$A_{3ABC} = A_{3A} + A_{3B} + A_{3C} = 20.84 + 17.32 + 5.97 = 44.13 \text{ acres}$$

$$Q_{3ABC} = (0.80)(0.798)(44.13)$$

$$Q_{3ABC} = 28.2 \text{ CFS}$$

BASIN #3 NORTH/SOUTH COMMON STREET (east of the Round About)

$$Q = C \times I \times A$$

$C = 0.80$ (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 2200 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 27 \text{ min.}$$

$$I_{100-5} = 0.737 \text{ at } 27 \text{ min.}$$

$$A_3 = A_{3A} + A_{3B} + A_{3C} + A_{3D} + A_{3E} = 20.84 + 17.32 + 5.97 + 1.71 + 1.85 = 47.69 \text{ acres}$$

$$Q_3 = (0.80)(0.737)(47.69)$$

$$Q_3 = 28.1 \text{ CFS}$$

BASIN #4 **16th STREET (east of Owens Street)**

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 1350 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 15 \text{ min.}$$

$$I_{100-5} = 0.960 \text{ at } 15 \text{ min.}$$

Subarea A is tributary.

$$A_{4A} = 11.63 \text{ acres}$$

$$Q_{4A} = (0.85)(0.960)(11.63)$$

$$Q_{4A} = 9.5 \text{ CFS}$$

BASIN #4 **OWENS STREET SOUTH (south of 16th Street)**

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 850 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 12 \text{ min.}$$

$$I_{100-5} = 1.046 \text{ at } 12 \text{ min.}$$

Subarea B is tributary.

$$A_{4B} = 11.24 \text{ acres}$$

$$Q_{4B} = (0.85)(1.046)(11.24)$$

$$Q_{4B} = 10.0 \text{ CFS}$$

BASIN #4 OWENS STREET SOUTH (south of the Round About)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 2950 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 36 \text{ min.}$$

$$I_{100-5} = 0.713 \text{ at } 36 \text{ min.}$$

$$A_4 = A_{4A} + A_{4B} + A_{4C} = 11.63 + 11.24 + 18.87 = 41.74 \text{ acres}$$

$$Q_4 = (0.85)(0.713)(41.74)$$

$$Q_4 = 25.3 \text{ CFS}$$

BASIN #5 ROUND ABOUT (local area)

$$Q = C \times I \times A$$

C = 0.80 (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 800 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 12 \text{ min.}$$

$$I_{100-5} = 1.046 \text{ at } 12 \text{ min.}$$

$$A_5 = 8.66 \text{ acres}$$

$$Q_5 = (0.80)(1.046)(8.66)$$

$$Q_5 = 7.2 \text{ CFS}$$

BASIN #345 ROUND ABOUT

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 3200 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 38 \text{ min.}$$

$$I_{100-5} = 0.698 \text{ at } 38 \text{ min.}$$

Basins 3, 4, and 5 are tributary

$$A_{345} = A_3 + A_4 + A_5 = 47.69 + 41.74 + 8.66 = 98.09 \text{ acres}$$

$$Q_{345} = (0.85)(0.698)(98.09)$$

$$Q_{345} = 58.2 \text{ CFS}$$

BASIN #6 OWENS STREET NORTH (lowpoint in center segment at China Basin Channel)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 600 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 10 \text{ min.}$$

$$I_{100-5} = 1.104 \text{ at 10 min.}$$

$$A_6 = 9.73 \text{ acres}$$

$$Q_6 = (0.85)(1.104)(9.73)$$

$$Q_6 = 9.1 \text{ CFS}$$

BASIN #7 OWENS STREET NORTH (lowpoint west of Fourth Street)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 2000 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 25 \text{ min.}$$

$$I_{100-5} = 0.787 \text{ at 25 min.}$$

$$A_7 = 28.82 \text{ acres}$$

$$Q_7 = (0.85)(0.787)(28.82)$$

$$Q_7 = 19.3 \text{ CFS}$$

BASIN #8 THIRD STREET (lowpoint south of Rincon Street)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 900 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 13 \text{ min.}$$

$$I_{100-5} = 0.989 \text{ at 13 min.}$$

$$A_8 = 6.31 \text{ acres}$$

$$Q_8 = (0.85)(0.989)(6.31)$$

$$Q_8 = 5.3 \text{ CFS}$$

Hydraulics/Open Channel Flow (Determine Flow Depth)

Given: Peak 100 Year less 5 Year flows established in the above section.

Find: Depth of flow in selected streets. Street geometry is based upon the *South of Channel Infrastructure Plan* prepared by KCA Engineers, Inc. in September 1998. Street cross slopes are conservatively assumed at 2%, gutter cross slope is assumed at 8% (SF Standard Details permit gutter cross-slope to match street cross-slope), and sidewalk cross slope is assumed at 1/5 inch per foot in accordance with the *Mission Bay Subdivision Regulations* (except where a 4% sidewalk cross-slope is required by the Conceptual Grading Plan). All top of curb elevations and street longitudinal slopes (channel slope) are based on the initial (pre-settlement) grades established on the *Conceptual Grading Plan* prepared by Santina & Thompson, Inc. and Hawk Engineers, Inc. dated December 1, 2000, and shown on the *Watershed Map for Overland Flow based on Initial (Pre-Settlement) Grades* dated December 1, 2000.

Manning's "n" is assumed as 0.016 for all streets.

Calcs: Channel flow calculations performed by Civil Tools v2.4.

BASIN #1 TERRY FRANÇOIS BOULEVARD (south of 13th Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 16.4
S (FT/FT) ? 0.0029

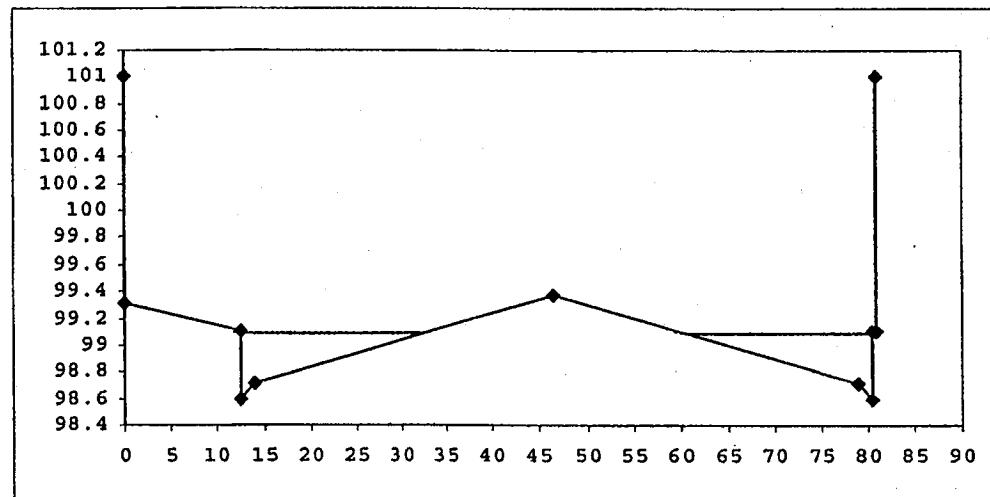
CROSS-SECTION POINTS

DIST	ELEV	COEFF
0	101.00	.016
0	99.31	.016
12.5	<u>99.10</u>	.016
12.5	98.60	.016
14	98.72	.016
46.5	99.37	.016
79	98.72	.016
80.5	98.60	.016
80.5	<u>99.10</u>	.016
81	99.10	.016
81	101.00	.016

RESULTS

=====

Y=	99.11 FT
A=	8.82 SF
P=	43.58 FT
V=	1.86 FPS
F=	0.72 SUB-CRITICAL FLOW



BASIN #1 THIRD STREET (south of 13th Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 12.1

S (FT/FT) ? .0025

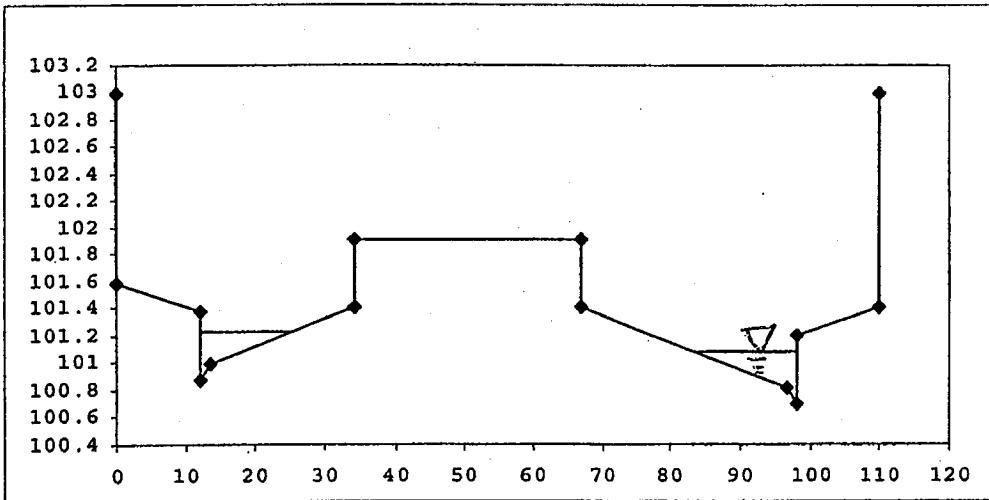
CROSS-SECTION POINTS
DIST ELEV COEFF

RESULTS

=====

Y= 101.24 FT
A= 7.19 SF
P= 39.78 FT
V= 1.68 FPS
F= 0.69 SUB-CRITICAL FLOW

DIST	ELEV	COEFF
0	103.00	.016
0	101.58	.016
12	101.38	.016
12	100.88	.016
13.5	101.00	.016
34	101.41	.016
34	101.91	.016
67	101.91	.016
67	101.41	.016
96.5	100.82	.016
98	100.70	.016
98	101.20	.016
110	101.40	.016
110	103.00	.016



BASIN #1 NORTH/SOUTH COMMON STREET (between Third St. and Terry François Blvd.)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 17.3

S (FT/FT) ? 0.0024

RESULTS

Y= 98.46 FT

A= 7.73 SF

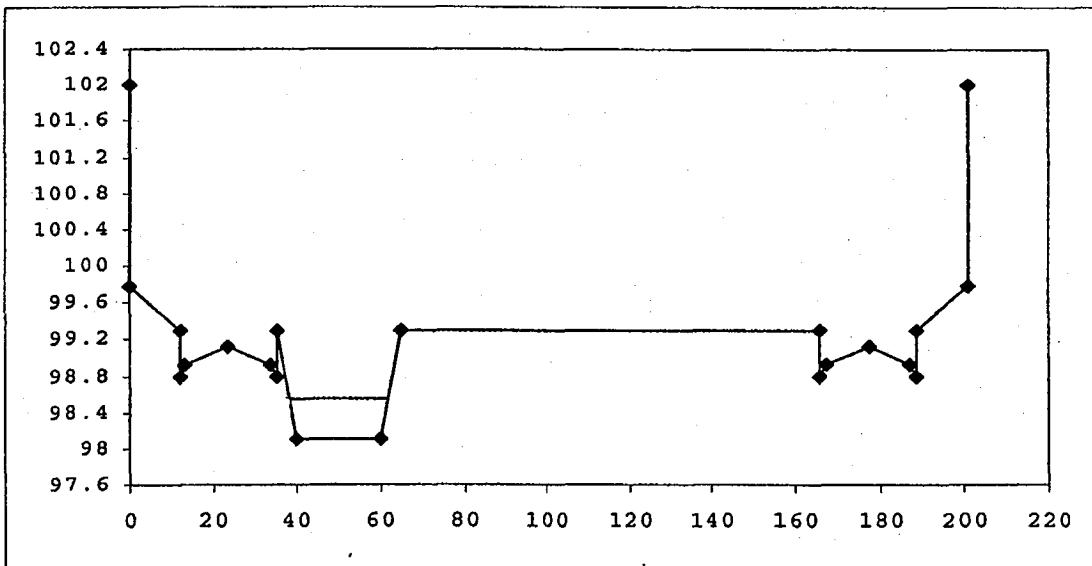
P= 23.08 FT

V= 2.24 FPS

F= 0.68 SUB-CRITICAL FLOW

CROSS-SECTION POINTS

DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	102.00	.016	60	98.10	.016
0	99.78	.016	65	99.30	.016
12	<u>99.30</u>	.016	165.75	<u>99.30</u>	.016
12	98.80	.016	165.75	98.80	.016
13.5	98.92	.016	167.25	98.92	.016
23.5	99.12	.016	177.25	99.12	.016
33.5	98.92	.016	187.25	98.92	.016
35	98.80	.016	188.75	98.80	.016
35	<u>99.30</u>	.016	188.75	<u>99.30</u>	.016
40	98.10	.016	200.75	99.78	.016
			200.75	102.00	.016



BASIN #1 TERRY FRANÇOIS BOULEVARD (at low point at South Common)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 39.0
S (FT/FT) ? 0.0018

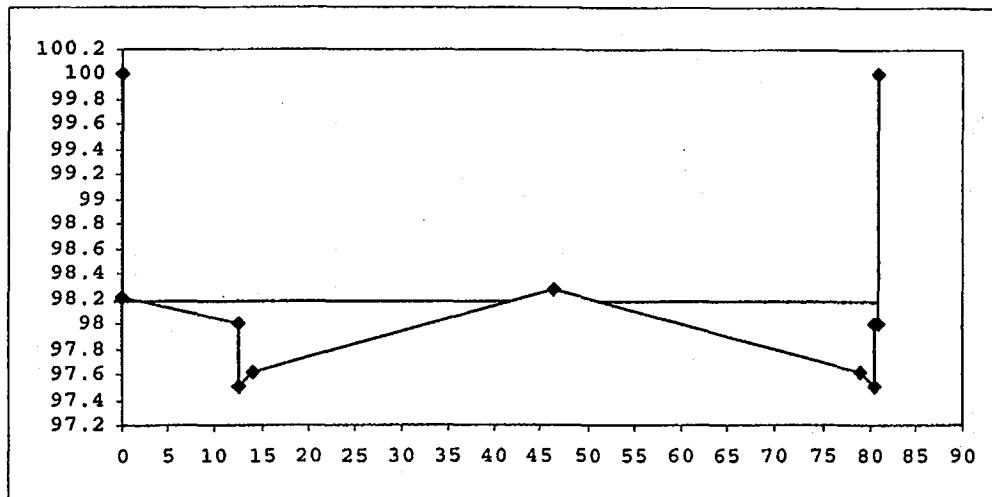
CROSS-SECTION POINTS
DIST ELEV COEFF

0	100.00	.016
0	98.21	.016
12.5	98.00	.016
12.5	97.50	.016
14	97.62	.016
46.5	98.27	.016
79	97.62	.016
80.5	97.50	.016
80.5	98.00	.016
81	98.00	.016
81	100.00	.016

RESULTS

=====

Y= 98.22 FT
A= 21.45 SF
P= 77.15 FT
V= 1.82 FPS
F= 0.60 SUB-CRITICAL FLOW



BASIN #2 ILLINOIS STREET (north of Mariposa Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 4.3

S (FT/FT) ? 0.0002

RESULTS

=====

Y= 100.61 FT

A= 8.81 SF

P= 41.81 FT

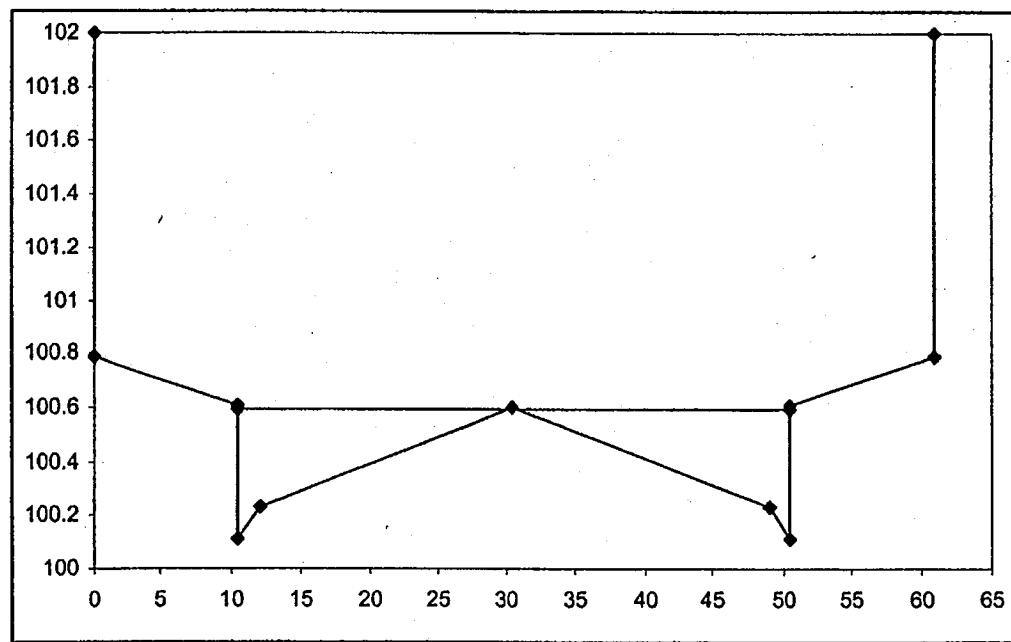
V= 0.50 FPS

F= 0.19 SUB-CRITICAL FLOW

CROSS-SECTION POINTS

DIST	ELEV	COEFF
------	------	-------

0	102.00	.016
0	100.78	.016
10.5	100.60	.016
10.5	100.10	.016
12	100.22	.016
30.5	100.59	.016
49	100.22	.016
50.5	100.10	.016
50.5	100.60	.016
61	100.78	.016
61	102.00	.016



BASIN #2 TERRY FRANÇOIS BOULEVARD (southern segment)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 11.0
S (FT/FT) ? 0.0005

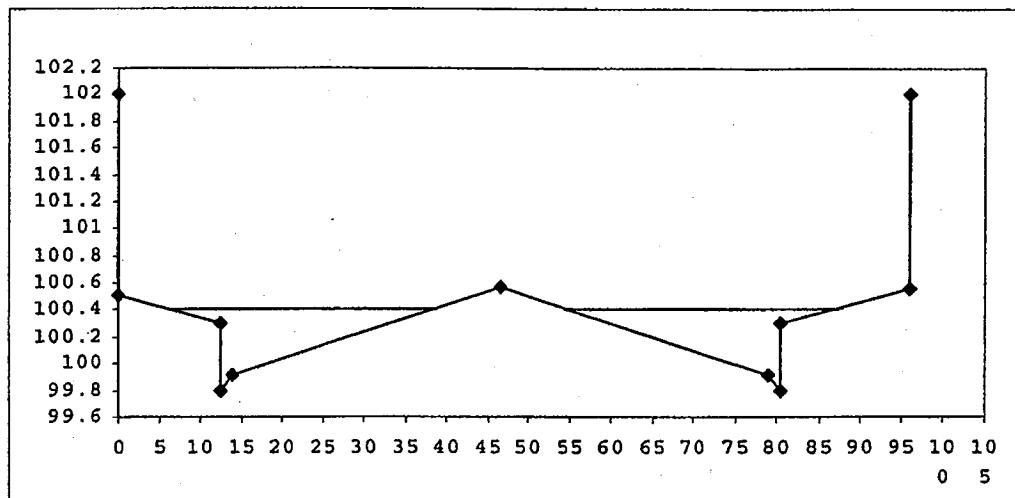
CROSS-SECTION POINTS
DIST ELEV COEFF

RESULTS

=====

Y= 100.39 FT
A= 13.20 SF
P= 62.04 FT
V= 0.84 FPS
F= 0.32 SUB-CRITICAL FLOW

DIST	ELEV	COEFF
0	102.00	.016
0	100.51	.016
12.5	100.30	.016
12.5	99.80	.016
14	99.92	.016
46.5	100.57	.016
79	99.92	.016
80.5	99.80	.016
80.5	100.30	.016
96	100.56	.016
96	102.00	.016



BASIN #3 NORTH/SOUTH COMMON STREET (at Sixth Street)

The routing of overland flow in Basin # 3 will vary depending on the specifics of the final grading and the underground piping for South and North Common Streets. The maximum street depth that can occur, however, is in the case where the maximum amount of run-off is assumed to accumulate at the low end of South Common Street, and is not divided between South and North Common Street. The following analysis assumes full loading of South Common Street alone.

Y - FLOW ELEVATION

Q - FLOWRATE

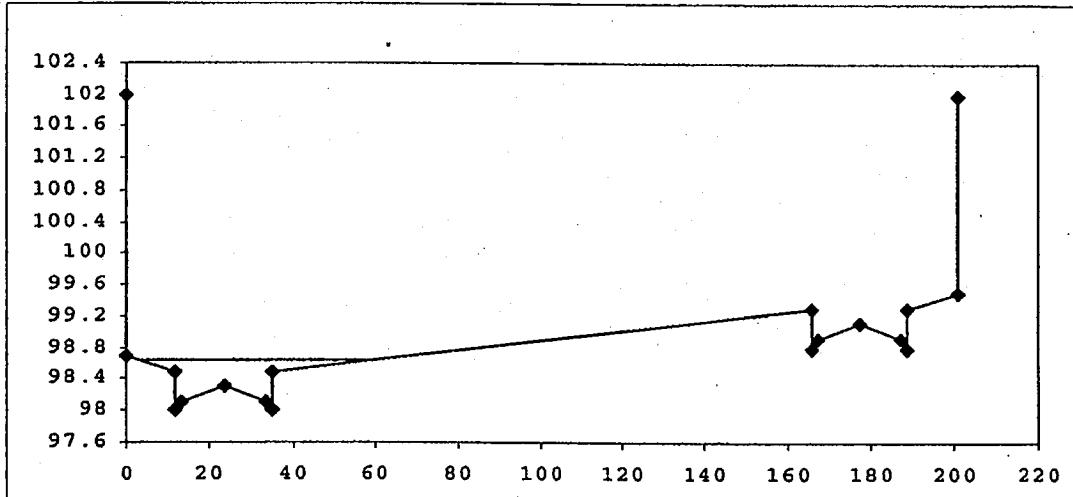
S - CHANNEL SLOPE

Q (CFS) ? 28.2
S (FT/FT) ? 0.0023

RESULTS
=====

Y=	98.64 FT
A=	12.41 SF
P=	55.61 FT
V=	2.27 FPS
F=	0.84 SUB-CRITICAL FLOW

CROSS-SECTION POINTS					
DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	102.00	.016	165.75	98.80	.016
0	98.70	.016	167.25	98.92	.016
12	98.50	.016	177.25	99.12	.016
12	98.00	.016	187.25	98.92	.016
13.5	98.12	.016	188.75	98.80	.016
23.5	98.32	.016	188.75	99.30	.016
33.5	98.12	.016	200.75	99.50	.016
35	98.00	.016	200.75	102.00	.016
35	98.50	.016			
165.75	99.30	.016			



BASIN #3 NORTH/SOUTH COMMON STREET (east of the Round About)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 28.1

S (FT/FT) ? .0039

RESULTS

Y= 98.25 FT

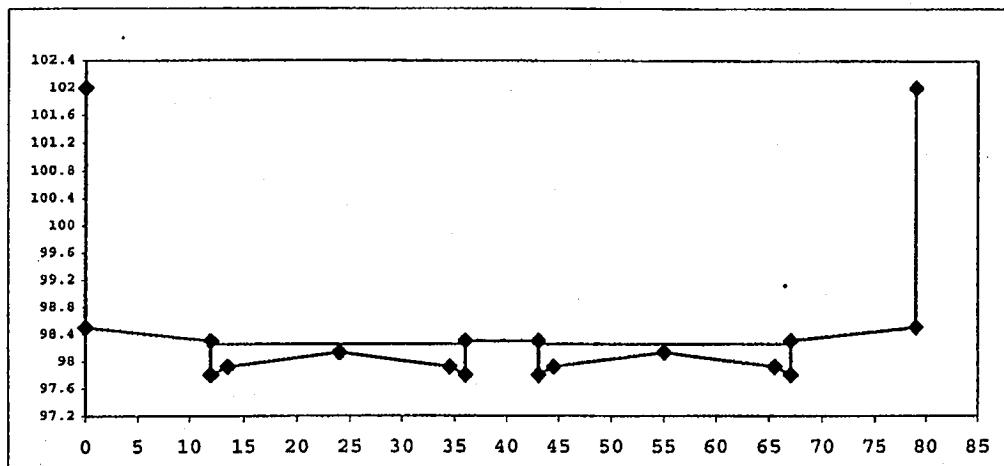
A= 11.95 SF

P= 49.84 FT

V= 2.35 FPS

F= 0.83 SUB-CRITICAL FLOW

CROSS-SECTION POINTS					
DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	102.00	.016	43	97.80	.016
0	98.50	.016	44.5	97.92	.016
12	<u>98.30</u>	.016	55	98.13	.016
12	97.80	.016	65.5	97.92	.016
13.5	97.92	.016	67	97.80	.016
24	98.13	.016	67	<u>98.30</u>	.016
34.5	97.92	.016	79	98.50	.016
36	97.80	.016	79	102.00	.016
36	<u>98.30</u>	.016			
43	<u>98.30</u>	.016			



BASIN #4 16TH STREET (east of Owens Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

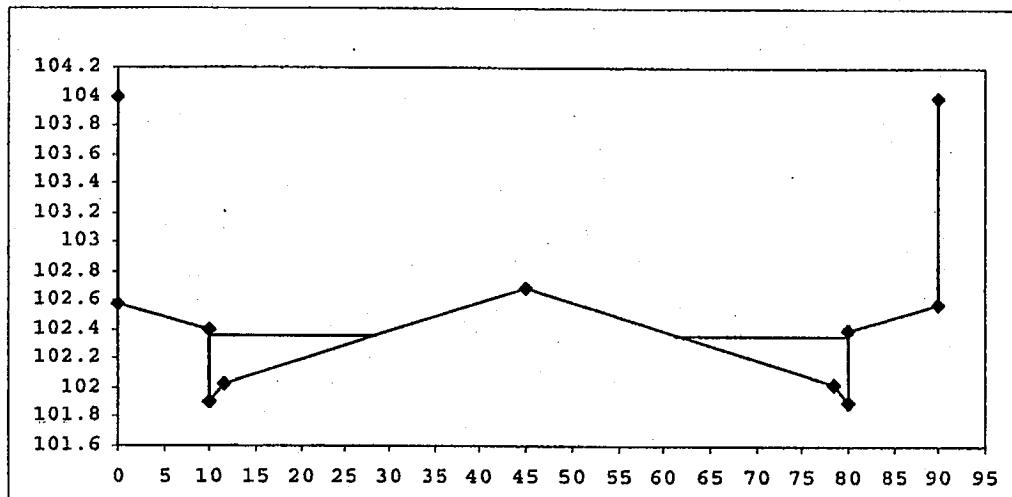
Q (CFS) ? 9.5
S (FT/FT) ? 0.0015

RESULTS

=====

Y= 102.37 FT
A= 7.46 SF
P= 39.24 FT
V= 1.27 FPS
F= 0.51 SUB-CRITICAL FLOW

CROSS-SECTION POINTS		
DIST	ELEV	COEFF
0	104.00	.016
0	102.57	.016
10	<u>102.40</u>	.016
10	101.90	.016
11.5	102.02	.016
45	102.69	.016
78.5	102.02	.016
80	101.90	.016
80	<u>102.40</u>	.016
90	102.57	.016
90	104.00	.016



BASIN #4 OWENS STREET (south of 16th Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 10.0
S (FT/FT) ? 0.0055

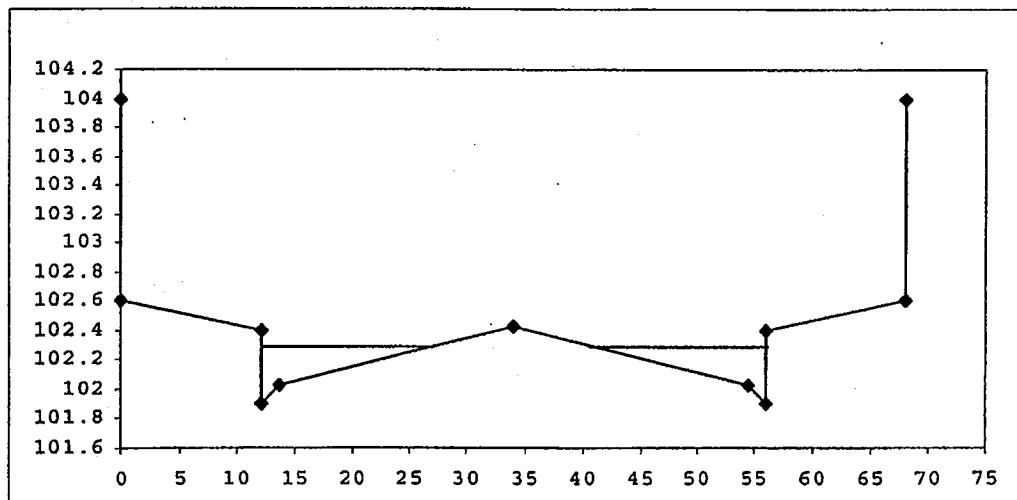
CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	104.00	.016
0	102.60	.016
12	<u>102.40</u>	.016
12	101.90	.016
13.5	102.02	.016
34	102.43	.016
54.5	102.02	.016
56	101.90	.016
56	<u>102.40</u>	.016
68	102.60	.016
68	104.00	.016

RESULTS

=====

Y= 102.29 FT
A= 4.69 SF
P= 30.98 FT
V= 2.13 FPS
F= 0.95 SUB-CRITICAL FLOW



BASIN #4 OWENS STREET (south of the Round About)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 25.3

S (FT/FT) ? 0.0022

CROSS-SECTION POINTS

DIST ELEV COEFF

0 101.00 .016

0 98.60 .016

12 98.40 .016

12 97.90 .016

13.5 98.02 .016

34 98.43 .016

54.5 98.02 .016

56 97.90 .016

56 98.40 .016

68 98.60 .016

68 101.00 .016

RESULTS

=====

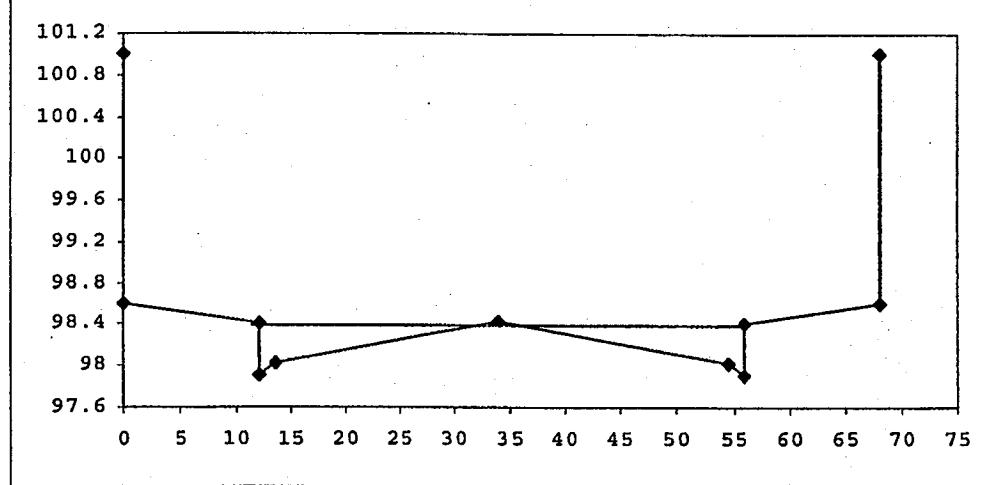
Y= 98.50 FT

A= 13.31 SF

P= 56.62 FT

V= 1.90 FPS

F= 0.68 SUB-CRITICAL FLOW



BASIN #345 ROUND ABOUT

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 58.2
S (FT/FT) ? 0.0009

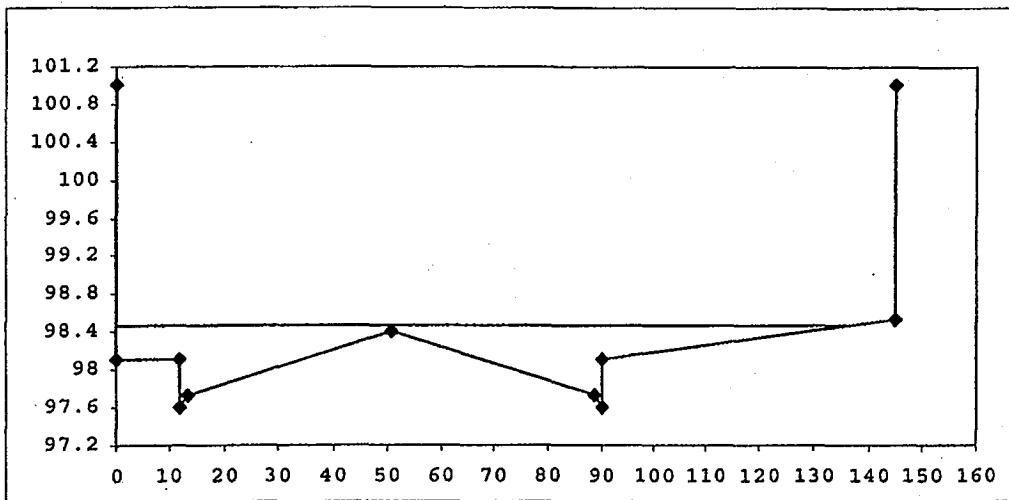
RESULTS

=====

Y= 98.43 FT
A= 43.07 SF
P= 145.44 FT
V= 1.35 FPS
F= 0.44 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

0 101.00 .016
0 98.10 .016
12 98.10 .016
12 97.60 .016
13.5 97.72 .016
51 98.41 .016
88.5 97.72 .016
90 97.60 .016
90 98.10 .016
145 98.54 .016
145 101.00 .016



BASIN #6 OWENS STREET NORTH (lowpoint in center segment at China Basin Channel)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 9.1
S (FT/FT) ? 0.0008

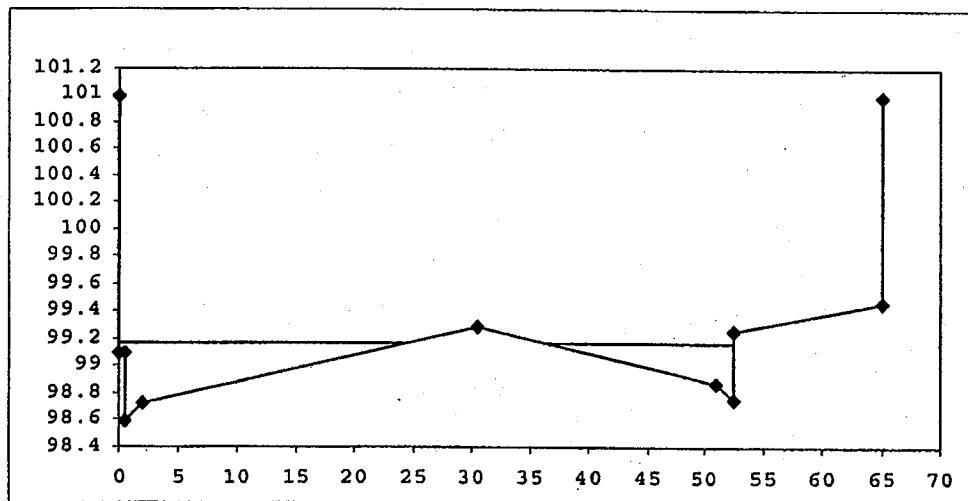
CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	101.00	.016
0	99.10	.016
0.5	99.10	.016
0.5	98.60	.016
2	98.72	.016
30.5	99.29	.016
51	98.88	.016
52.5	98.76	.016
52.5	99.26	.016
65	99.47	.016
65	101.00	.016

RESULTS

=====

Y= 99.18 FT
A= 9.02 SF
P= 42.82 FT
V= 1.01 FPS
F= 0.38 SUB-CRITICAL FLOW



BASIN #7 OWENS STREET NORTH (lowpoint west of Fourth Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

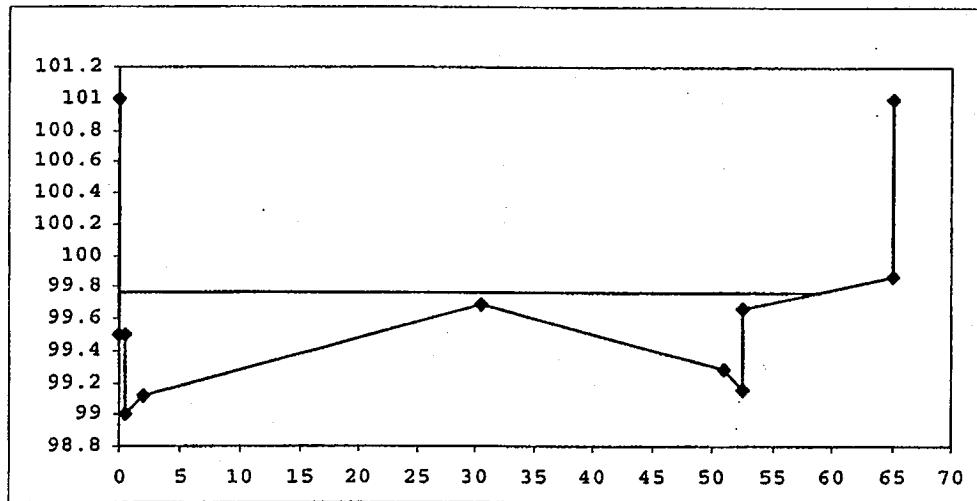
Q (CFS) ? 19.3
S (FT/FT) ? 0.0005

RESULTS

=====

Y= 99.77 FT
A= 18.42 SF
P= 57.12 FT
V= 1.05 FPS
F= 0.32 SUB-CRITICAL FLOW

CROSS-SECTION POINTS		
DIST	ELEV	COEFF
0	101.00	.016
0	99.50	.016
0.5	99.50	.016
0.5	99.00	.016
2	99.12	.016
30.5	99.69	.016
51	99.28	.016
52.5	99.16	.016
52.5	99.66	.016
65	99.87	.016
65	101.00	.016



BASIN #8 THIRD STREET (lowpoint south of Rincon Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

VARIABLE TO BE SOLVED (Y,Q OR S) ? Y

Enter up to 20 cross-section poi
 Enter <Return> only for distance to

Q (CFS) ? 5.3

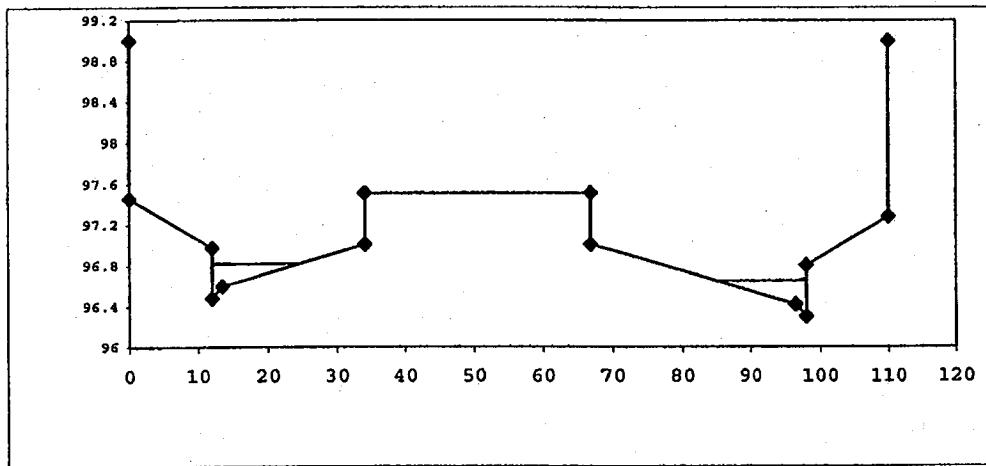
S (FT/FT) ? 0.007

RESULTS

=====

Y= 96.67 FT
A= 2.39 SF
P= 19.82 FT
V= 2.22 FPS
F= 1.11 SUPER-CRITICAL FLOW

CROSS-SECTION POINTS					
DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	99.00	.016	98	96.30	.016
0	97.46	.016	98	96.80	.016
12	96.98	.016	110	97.28	.016
12	96.48	.016	110	99.00	.016
13.5	96.60	.016			
34	97.01	.016			
34	97.51	.016			
67	97.51	.016			
67	97.01	.016			
96.5	96.42	.016			



FINAL (50 YEAR SETTLEMENT) GRADES

Given: Run-off generated by the 5 year design storm, and only run-off generated by the 5 year design storm, will be carried away by the underground storm drain system.

Find: The depth of flow in surface streets generated by excess run-off during the 100 year storm event.

Watersheds: Watersheds are based on final (50 year settlement) grades, as established on the *Conceptual Grading Plan* prepared by Santina & Thompson Inc. and Hawk Engineers Inc. dated December 1, 2000. The *Watershed Map for Overland Flow based on Final (50 Year Settlement) Grades* dated December 1, 2000 indicates the proposed drainage basins, direction of flow, drainage areas, and street slopes, used in these calculations. Basin numbers referenced below refer to the Watershed Map.

Standards: All calculations are in accordance with Section XVIII "Required Capacity of Separated Storm Drain System" of the *Mission Bay Subdivision Regulations* dated 1998.

Calculations: All run-off calculations have been performed using the "Rational Method".

Intensities: 5 Year rainfall intensities are taken from the tabulation entitled "San Francisco Rainfall Rate Table 1941" Plan L-3903.4, dated February 1941, and subsequent revisions, as required by the above document. 100 Year rainfall intensities are from the California State Department of Water Resources (CSDWR), developed by Jim Goodridge using Federal Rainfall records in San Francisco. Provided by Leah Orloff of the San Francisco Public Utilities Commission.

Time (minutes)	Intensity 100 Year	Intensity 5 Year	Intensity 100-5 Year
5	4.800	3.126	1.674
6	4.390	2.922	1.468
7	4.240	2.742	1.498
10	3.420	2.316	1.104
15	2.800	1.840	0.960
20	2.370	1.526	0.844
25	2.090	1.303	0.787
30	1.800	1.137	0.663
35	1.730	1.009	0.721
40	1.600	0.918	0.682
45	1.500	0.856	0.644
50	1.420	0.805	0.615
55	1.340	0.762	0.578
60	1.280	0.723	0.557
65	1.230	0.690	0.540
70	1.180	0.661	0.519
75	1.130	0.635	0.495
80	1.100	0.611	0.489
85	1.060	0.590	0.470
90	1.030	0.570	0.460

Coefficient: Table 1 "Coefficients of Run-Off And Inlet Times" contained in the Mission Bay Subdivision Regulations requires a coefficient of 0.80 to 0.96 for "commercial" areas. A coefficient of 0.85 has been selected based on the future development of the area. A coefficient of 0.80 in watersheds containing park land (east of Terry François Blvd. and between North and South Common).

Hydrology (Quantify Flows)

BASIN #1 TERRY FRANÇOIS BOULEVARD (south of 13th Street)

$$Q = C \times I \times A$$

C = 0.80 (Commercial area with some park land.)

Time of Concentration

- Assume time to street equals 3 minutes. (SF Standards require 5 minutes to the first inlet. Time to the curb would be somewhat less and is estimated to be 3 minutes.)
- Street travel time is calculated at 1.5 fps velocity (flat slopes).

$$t_c = 3 \text{ min.} + 1750 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 22 \text{ min.}$$

$$I_{100-5} = 0.821 \text{ at } 22 \text{ min.}$$

Subarea A is tributary.

$$A_{1A} = 24.95 \text{ acres}$$

$$Q_{1A} = (0.80)(0.821)(24.95)$$

$$Q_{1A} = 16.4 \text{ CFS}$$

BASIN #1 THIRD STREET (south of 13th Street)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 1850 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 23 \text{ min.}$$

$$I_{100-5} = 0.810 \text{ at } 23 \text{ min.}$$

Subarea B is tributary.

$$A_{1B} = 17.53 \text{ acres}$$

$$Q_{1B} = (0.85)(0.810)(17.53)$$

$$Q_{1B} = 12.1 \text{ CFS}$$

BASIN #1

NORTH/SOUTH COMMON STREET (Between Third St. and Terry Fran ois Blvd.)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 2700 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 33 \text{ min.}$$

$$I_{100-5} = 0.698 \text{ at } 33 \text{ min.}$$

Subareas B and C are tributary.

$$A_{1BC} = A_{1B} + A_{1C} = 17.53 + 11.59 = 29.12 \text{ acres}$$

$$Q_{1BC} = (0.85)(0.698)(29.12)$$

$$Q_{1BC} = 17.3 \text{ CFS}$$

BASIN #1

TERRY FRAN OIS BOULEVARD (at low point at South Common)

$$Q = C \times I \times A$$

C = 0.83 (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 3100 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 37 \text{ min.}$$

$$I_{100-5} = 0.705 \text{ at } 37 \text{ min.}$$

$$A_1 = A_{1A} + A_{1B} + A_{1C} + A_{1D} = 24.95 + 17.53 + 11.59 + 14.42 = 68.49 \text{ acres}$$

$$Q_1 = (0.83)(0.705)(68.49)$$

$$Q_1 = 40.1 \text{ CFS}$$

BASIN #2 ILLINOIS STREET (north of Mariposa Street)

$$Q = C \times I \times A$$

$C = 0.85$ (Commercial area.)

$$t_c = 3 \text{ min.} + 850 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 12 \text{ min.}$$

$$I_{100-5} = 1.046 \text{ at } 12 \text{ min.}$$

Subarea A is tributary.

$$A_{2A} = 4.86 \text{ acres}$$

$$Q_{2A} = (0.85)(1.046)(4.86)$$

$$Q_{2A} = 4.3 \text{ CFS}$$

BASIN #2 TERRY FRANÇOIS BOULEVARD (at low point north of Mariposa Street)

$$Q = C \times I \times A$$

$C = 0.85$ (Commercial area.)

$$t_c = 3 \text{ min.} + 1600 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 20 \text{ min.}$$

$$I_{100-5} = 0.844 \text{ at } 20 \text{ min.}$$

$$A_2 = A_{2A} + A_{2B} = 4.86 + 10.49 = 15.35 \text{ acres}$$

$$Q_2 = (0.85)(0.844)(15.35)$$

$$Q_2 = 11.0 \text{ CFS}$$

BASIN #3 NORTH/SOUTH COMMON STREET (at Sixth Street)

At 50 years, anticipated settlement will bring North and South Common Streets to the same elevation. Accumulated run-off will enter primarily onto South Common Street and will spread evenly across the full North/South Common street section at Sixth Street.

$$Q = C \times I \times A$$

C = 0.80 (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 1900 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 24 \text{ min.}$$

$$I_{100-5} = 0.798 \text{ at } 24 \text{ min.}$$

Subareas A is tributary.

$$A_{3A} = 26.19 \text{ acres}$$

$$Q_{3ABC} = (0.80)(0.798)(26.19)$$

$$Q_{3ABC} = 16.7 \text{ CFS}$$

BASIN #3 NORTH/SOUTH COMMON STREET (east of the Round About)

$$Q = C \times I \times A$$

C = 0.80 (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 2200 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 27 \text{ min.}$$

$$I_{100-5} = 0.737 \text{ at } 27 \text{ min.}$$

$$A_3 = A_{3A} + A_{3B} = 35.28 \text{ acres}$$

$$Q_3 = (0.80)(0.737)(35.28)$$

$$Q_3 = 20.8 \text{ CFS}$$

BASIN #4 **16th STREET (east of Owens Street)**

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 1350 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 15 \text{ min.}$$

$$I_{100-5} = 0.960 \text{ at } 15 \text{ min.}$$

Subarea A is tributary.

$$A_{4A} = 11.63 \text{ acres}$$

$$Q_{4A} = (0.85)(0.960)(11.63)$$

$$Q_{4A} = 9.5 \text{ CFS}$$

BASIN #4 **OWENS STREET SOUTH (south of 16th Street)**

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 850 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 12 \text{ min.}$$

$$I_{100-5} = 1.046 \text{ at } 12 \text{ min.}$$

Subarea B is tributary.

$$A_{4B} = 11.24 \text{ acres}$$

$$Q_{4B} = (0.85)(1.046)(11.24)$$

$$Q_{4B} = 10.0 \text{ CFS}$$

BASIN #4 OWENS STREET SOUTH (south of the Round About)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 2950 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 36 \text{ min.}$$

$$I_{100-5} = 0.713 \text{ at } 36 \text{ min.}$$

$$A_4 = A_{4A} + A_{4B} + A_{4C} = 11.63 + 11.24 + 18.87 = 41.74 \text{ acres}$$

$$Q_4 = (0.85)(0.713)(41.74)$$

$$Q_4 = 25.3 \text{ CFS}$$

BASIN #5 ROUND ABOUT (local area)

$$Q = C \times I \times A$$

C = 0.80 (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 800 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 12 \text{ min.}$$

$$I_{100-5} = 1.046 \text{ at } 12 \text{ min.}$$

$$A_5 = 8.66 \text{ acres}$$

$$Q_5 = (0.80)(1.046)(8.66)$$

$$Q_5 = 7.2 \text{ CFS}$$

BASIN #345 ROUND ABOUT

$$Q = C \times I \times A$$

C = 0.83 (Commercial area with some park land.)

$$t_c = 3 \text{ min.} + 3200 \text{ ft}/1.5 \text{fps}/60 \text{sec}/\text{min} = 38 \text{ min.}$$

$$I_{100-5} = 0.698 \text{ at } 38 \text{ min.}$$

Basins 3, 4, and 5 are tributary

$$A_{345} = A_3 + A_4 + A_5 = 35.28 + 41.74 + 8.66 = 85.68 \text{ acres}$$

$$Q_{345} = (0.83)(0.698)(85.68)$$

$$Q_{345} = 49.6 \text{ CFS}$$

BASIN #6 OWENS STREET NORTH (lowpoint in center segment at China Basin Channel)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 1450 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 19 \text{ min.}$$

$$I_{100-5} = 0.867 \text{ at } 19 \text{ min.}$$

$$A_6 = 21.78 \text{ acres}$$

$$Q_6 = (0.85)(0.867)(21.78)$$

$$Q_6 = 16.1 \text{ CFS}$$

BASIN #7 OWENS STREET NORTH (lowpoint west of Fourth Street)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 1400 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 19 \text{ min.}$$

$$I_{100-5} = 0.867 \text{ at } 19 \text{ min.}$$

$$A_7 = 18.05 \text{ acres}$$

$$Q_7 = (0.85)(0.867)(18.05)$$

$$Q_7 = 13.3 \text{ CFS}$$

BASIN #8 THIRD STREET (lowpoint south of Rincon Street)

$$Q = C \times I \times A$$

C = 0.85 (Commercial area.)

$$t_c = 3 \text{ min.} + 1730 \text{ ft}/1.5 \text{fps}/60 \text{sec/min} = 22 \text{ min.}$$

$$I_{100-5} = 0.821 \text{ at } 22 \text{ min.}$$

$$A_8 = 17.70 \text{ acres}$$

$$Q_8 = (0.85)(0.821)(17.70)$$

$$Q_8 = 12.4 \text{ CFS}$$

Hydraulics/Open Channel Flow (Determine Flow Depth)

Given: Peak 100 Year less 5 Year flows established in the above section.

Find: Depth of flow in selected streets. Street geometry is based upon the *South of Channel Infrastructure Plan* prepared by KCA Engineers, Inc. in September 1998. Street cross slopes are conservatively assumed at 2%, gutter cross slope is assumed at 8% (SF Standard Details permit gutter cross-slope to match street cross-slope), and sidewalk cross slope is assumed at 1/5 inch per foot in accordance with the *Mission Bay Subdivision Regulations* (except where a 4% sidewalk cross-slope is required by the Conceptual Grading Plan). All top of curb elevations and street longitudinal slopes (channel slope) are based on the final (50 year settlement) grades established on the *Conceptual Grading Plan* prepared by Santina & Thompson Inc, and Hawk Engineers Inc. dated December 1, 2000, and shown on the *Watershed Map for Overland Flow based on the final (50 year settlement) Grades* dated December 1, 2000.

Manning's "n" is assumed as 0.016 for all streets.

Calcs: Channel flow calculations performed by Civil Tools v2.4.

BASIN #1 TERRY FRANÇOIS BOULEVARD (south of 13th Street)

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

Q (CFS) ? 16.4
S (FT/FT) ? 0.0029

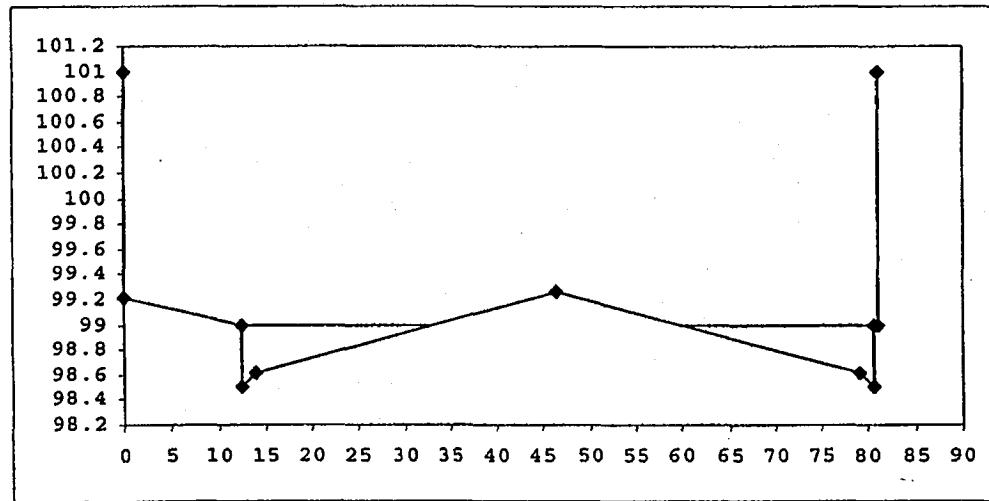
CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	101.00	.016
0	99.21	.016
12.5	99.00	.016
12.5	98.50	.016
14	98.62	.016
46.5	99.27	.016
79	98.62	.016
80.5	98.50	.016
80.5	99.00	.016
81	99.00	.016
81	101.00	.016

RESULTS

=====

Y= 99.01 FT
A= 8.82 SF
P= 43.58 FT
V= 1.86 FPS
F= 0.72 SUB-CRITICAL FLOW



BASIN #1 THIRD STREET (south of 13th Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 12.1
S (FT/FT) ? 0.0025

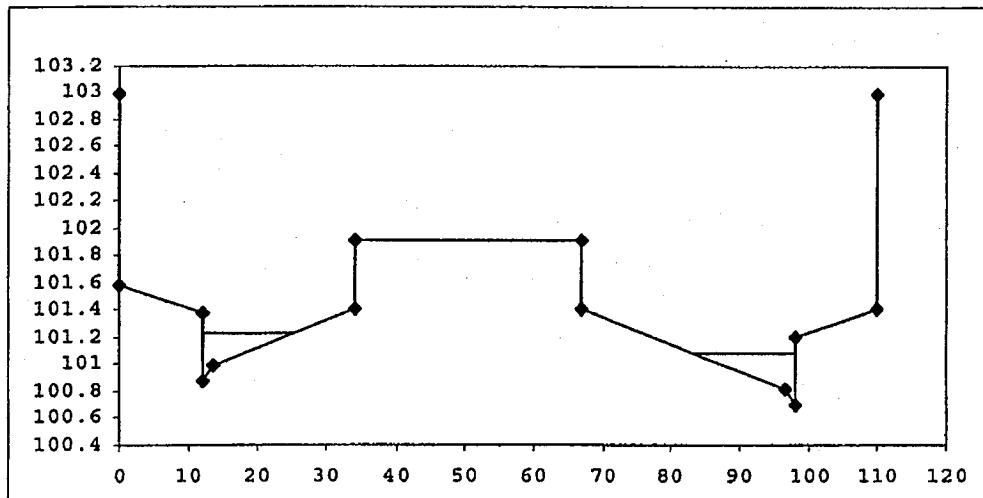
RESULTS

=====

Y= 101.24 FT
A= 7.19 SF
P= 39.78 FT
V= 1.68 FPS
F= 0.69 SUB-CRITICAL FLOW

ROSS-SECTION POINTS
IST ELEV COEFF

IST	ELEV	COEFF
0	103.00	.016
0	101.58	.016
12	101.38	.016
12	100.88	.016
13.5	101.00	.016
34	101.41	.016
34	101.91	.016
67	101.91	.016
67	101.41	.016
96.5	100.82	.016
98	100.70	.016
98	101.20	.016
110	101.40	.016
110	103.00	.016



BASIN #1 NORTH/SOUTH COMMON STREET (between Third St. and Terry François Blvd.)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

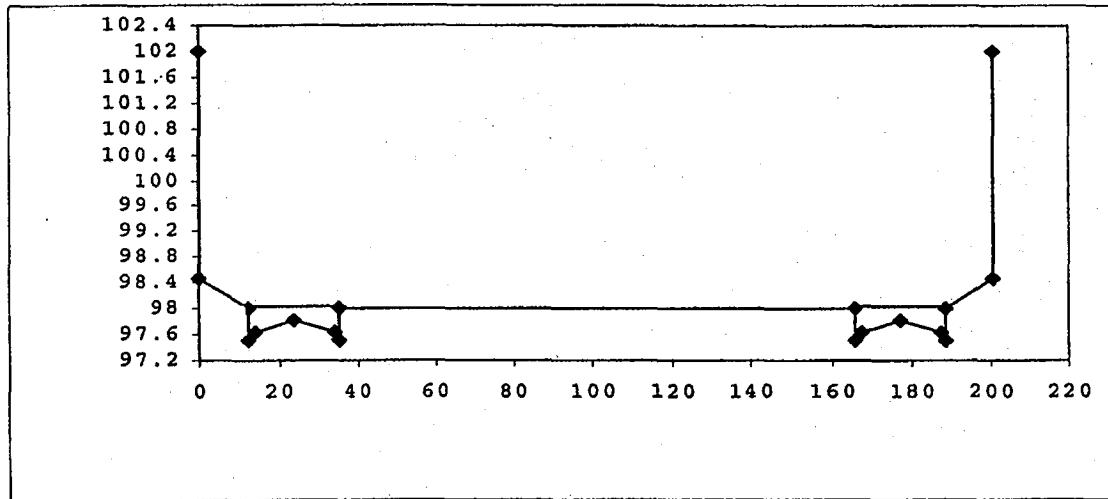
Q (CFS) ? 17.3
S (FT/FT) ? 0.0018

RESULTS

=====

Y= 97.94 FT
A= 11.06 SF
P= 47.79 FT
V= 1.56 FPS
F= 0.56 SUB-CRITICAL FLOW

CROSS-SECTION POINTS					
DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	102.00	.016	165.75	97.50	.016
0	98.48	.016	167.25	97.62	.016
12	98.00	.016	177.25	97.82	.016
12	97.50	.016	187.25	97.62	.016
13.5	97.62	.016	188.75	97.50	.016
23.5	97.82	.016	188.75	98.00	.016
33.5	97.62	.016	200.75	98.48	.016
35	97.50	.016	200.75	102.00	.016
35	98.00	.016			
165.75	98.00	.016			



BASIN #1 TERRY FRANÇOIS BOULEVARD (at low point at South Common)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 40.1
S (FT/FT) ? 0.0018

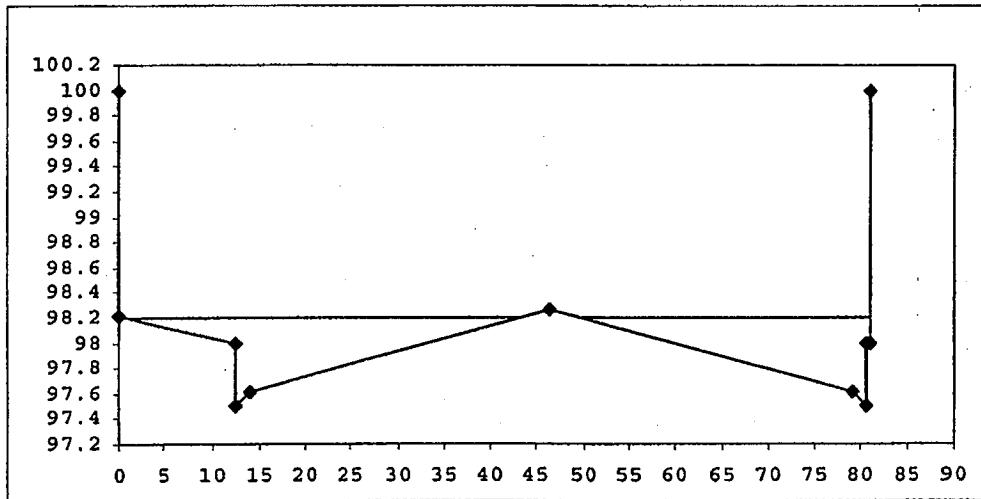
RESULTS

=====

Y= 98.23 FT
A= 21.92 SF
P= 77.78 FT
V= 1.83 FPS
F= 0.60 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	100.00	.016
0	98.21	.016
12.5	98.00	.016
12.5	97.50	.016
14	97.62	.016
46.5	98.27	.016
79	97.62	.016
80.5	97.50	.016
80.5	98.00	.016
81	98.00	.016
81	100.00	.016



BASIN #2 ILLINOIS STREET (north of Mariposa Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 4.3

S (FT/FT) ? 0.0002

CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	102.00	.016
0	100.78	.016
10.5	100.60	.016
10.5	100.10	.016
12	100.22	.016
30.5	100.59	.016
49	100.22	.016
50.5	100.10	.016
50.5	100.60	.016
61	100.78	.016
61	102.00	.016

RESULTS

=====

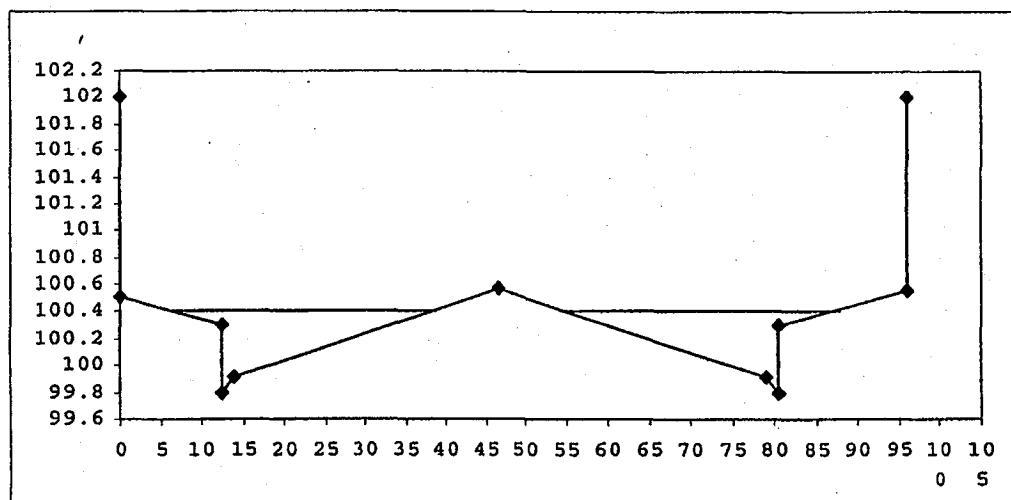
Y= 100.61 FT

A= 8.81 SF

P= 41.81 FT

V= 0.50 FPS

F= 0.19 SUB-CRITICAL FLOW



BASIN #2 TERRY FRANÇOIS BOULEVARD (southern segment)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 11.0
S (FT/FT) ? 0.0005

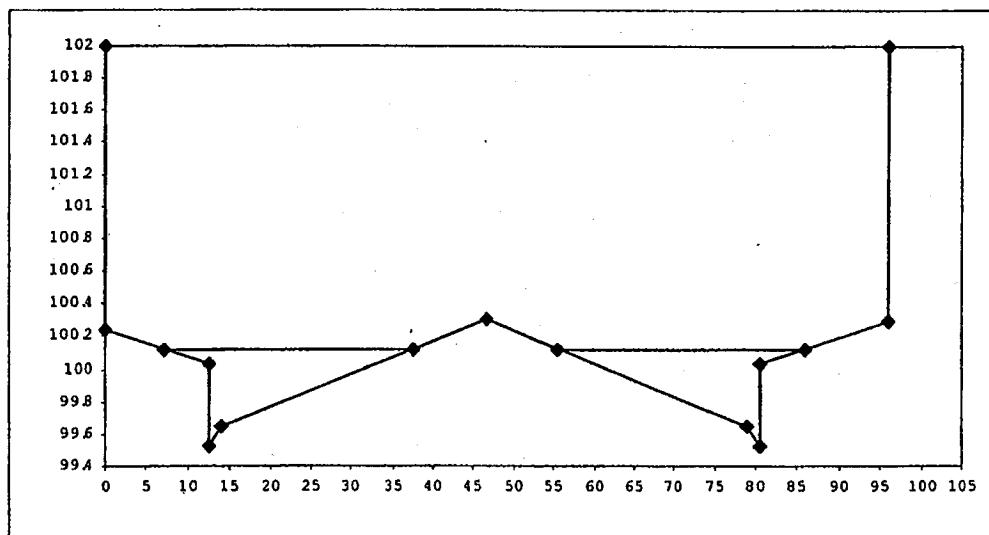
RESULTS

=====

Y= 100.39 FT
A= 13.20 SF
P= 62.04 FT
V= 0.84 FPS
F= 0.32 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	102.00	.016
0	100.51	.016
12.5	100.30	.016
12.5	99.80	.016
14	99.92	.016
46.5	100.57	.016
79	99.92	.016
80.5	99.80	.016
80.5	100.30	.016
96	100.56	.016
96	102.00	.016



BASIN #3 NORTH/SOUTH COMMON STREET (at Sixth Street)

Y - FLOW ELEVATION

Q - FLOWRATE

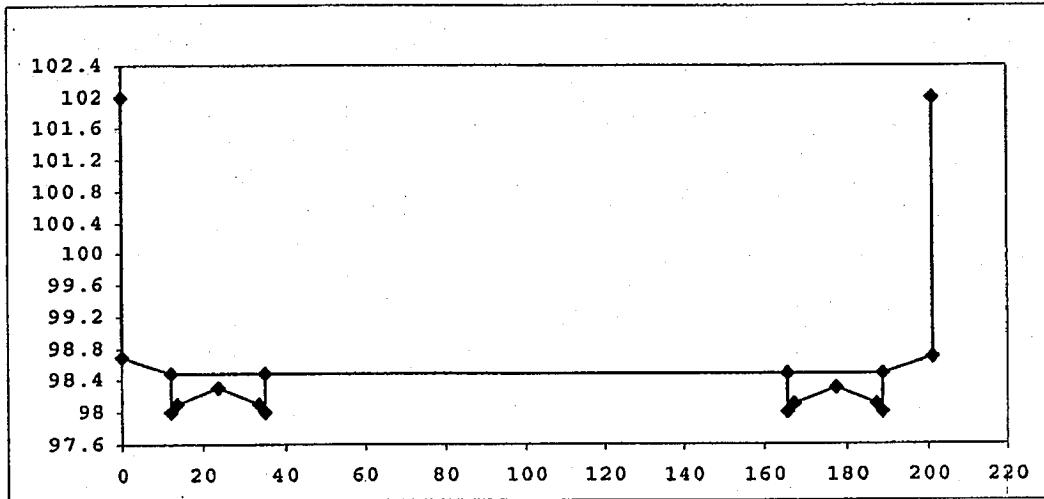
S - CHANNEL SLOPE

Q (CFS) ? 16.7
S (FT/FT) ? 0.0011

RESULTS

Y= 98.47 FT
A= 12.60 SF
P= 47.92 FT
V= 1.33 FPS
F= 0.45 SUB-CRITICAL FLOW

CROSS-SECTION POINTS					
DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	102.00	.016	165.75	98.00	.016
0	98.70	.016	167.25	98.12	.016
12	<u>98.50</u>	.016	177.25	98.32	.016
12	98.00	.016	187.25	98.12	.016
13.5	98.12	.016	188.75	98.00	.016
23.5	98.32	.016	188.75	<u>98.50</u>	.016
33.5	98.12	.016	200.75	98.70	.016
35	98.00	.016	200.70	102.00	.016
35	<u>98.50</u>	.016			
165.75	<u>98.50</u>	.016			



BASIN #3 NORTH/SOUTH COMMON STREET (east of the Round About)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

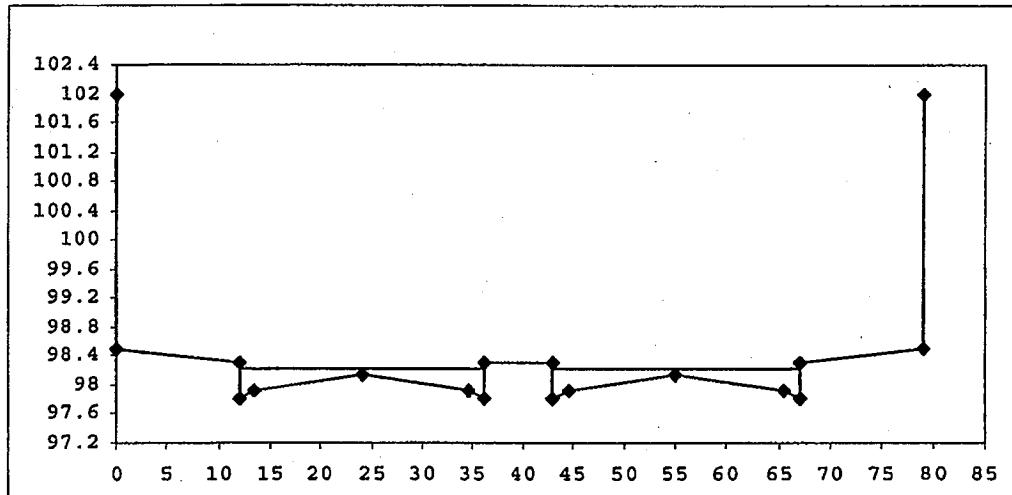
Q (CFS) ? 20.8
S (FT/FT) ? 0.0039

RESULTS

=====

Y= 98.21 FT
A= 9.91 SF
P= 49.67 FT
V= 2.10 FPS
F= 0.81 SUB-CRITICAL FLOW

CROSS-SECTION POINTS					
DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	102.00	.016	43	97.80	.016
0	98.50	.016	44.5	97.92	.016
12	98.30	.016	55	98.13	.016
12	97.80	.016	65.5	97.92	.016
13.5	97.92	.016	67	97.80	.016
24	98.13	.016	67	98.30	.016
34.5	97.92	.016	79	98.50	.016
36	97.80	.016	79	102.00	.016
36	98.30	.016			
43	98.30	.016			



BASIN #4 16TH STREET (east of Owens Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 9.5

S (FT/FT) ? 0.0015

RESULTS

Y= 102.37 FT

A= 7.46 SF

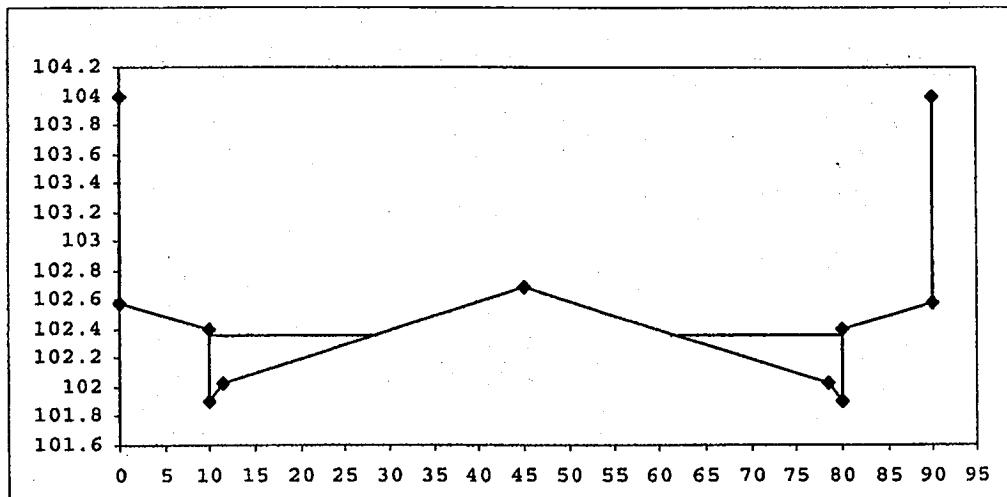
P= 39.24 FT

V= 1.27 FPS

F= 0.51 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	104.00	.016
0	102.57	.016
10	<u>102.40</u>	.016
10	101.90	.016
11.5	102.02	.016
45	102.69	.016
78.5	102.02	.016
80	101.90	.016
80	<u>102.40</u>	.016
90	102.57	.016
90	104.00	.016



BASIN #4 OWENS STREET (south of 16th Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 10.0
S (FT/FT) ? 0.0055

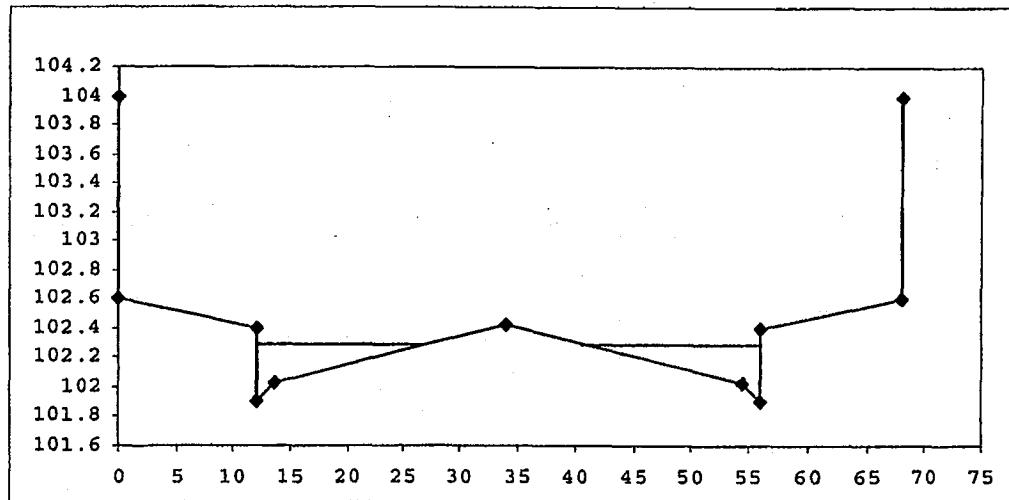
RESULTS

=====

Y= 102.29 FT
A= 4.69 SF
P= 30.98 FT
V= 2.13 FPS
F= 0.95 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

0 104.00 .016
0 102.60 .016
12 102.40 .016
12 101.90 .016
13.5 102.02 .016
34 102.43 .016
54.5 102.02 .016
56 101.90 .016
56 102.40 .016
68 102.60 .016
68 104.00 .016



BASIN #4 OWENS STREET (south of the Round About)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 25.3

S (FT/FT) ? 0.0019

RESULTS

Y= 98.71 FT

A= 14.03 SF

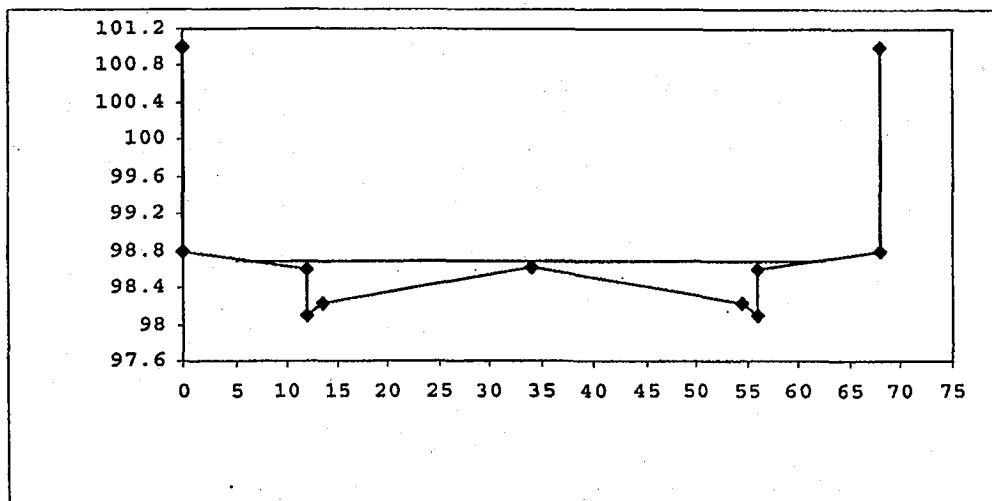
P= 58.15 FT

V= 1.80 FPS

F= 0.64 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	101.00	.016
0	98.80	.016
12	98.60	.016
12	98.10	.016
13.5	98.22	.016
34	98.63	.016
54.5	98.22	.016
56	98.10	.016
56	98.60	.016
68	98.80	.016
68	101.00	.016



BASIN #345 ROUND ABOUT

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 49.6

S (FT/FT) ? 0.0009

RESULTS

=====

Y= 98.41 FT

A= 37.49 SF

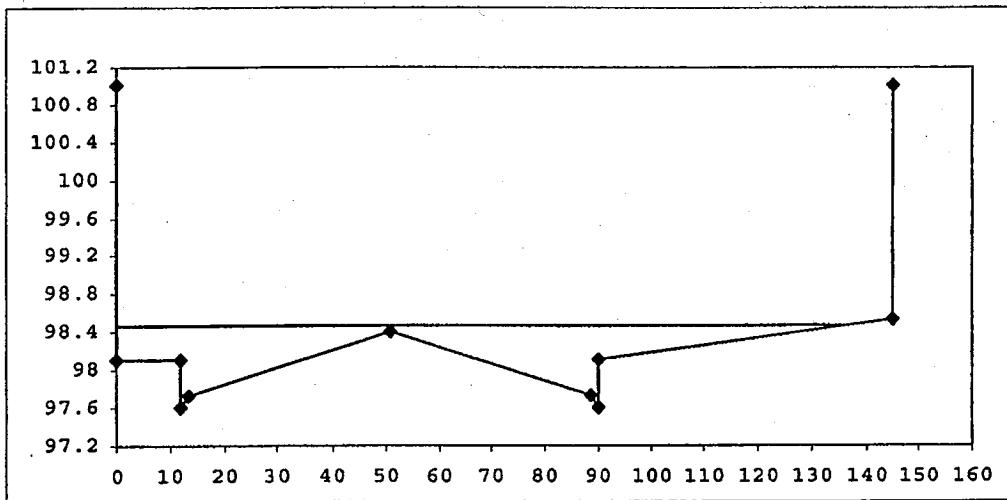
P= 129.42 FT

V= 1.32 FPS

F= 0.43 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	101.00	.016
0	98.10	.016
12	98.10	.016
12	97.60	.016
13.5	97.72	.016
51	98.41	.016
88.5	97.72	.016
90	97.60	.016
90	98.10	.016
145	98.54	.016
145	101.00	.016



BASIN #6 OWENS STREET NORTH (lowpoint in center segment at China Basin Channel)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

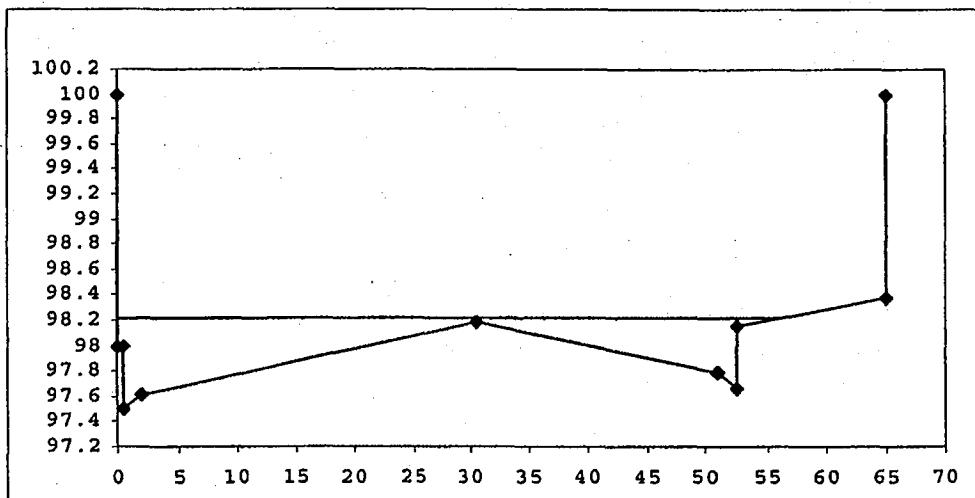
Q (CFS) ? 16.1
S (FT/FT) ? 0.0006

RESULTS

=====

Y= 98.22 FT
A= 15.49 SF
P= 57.03 FT
V= 1.04 FPS
F= 0.35 SUB-CRITICAL FLOW

CROSS-SECTION POINTS		
DIST	ELEV	COEFF
0	100.00	.016
0	98.00	.016
0.5	98.00	.016
0.5	97.50	.016
2	97.62	.016
30.5	98.19	.016
51	97.78	.016
52.5	97.66	.016
52.5	98.16	.016
65	98.37	.016
65	100.00	.016



BASIN #7

OWENS STREET NORTH (lowpoint west of Fourth Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 13.3
S (FT/FT) ? 0.0014

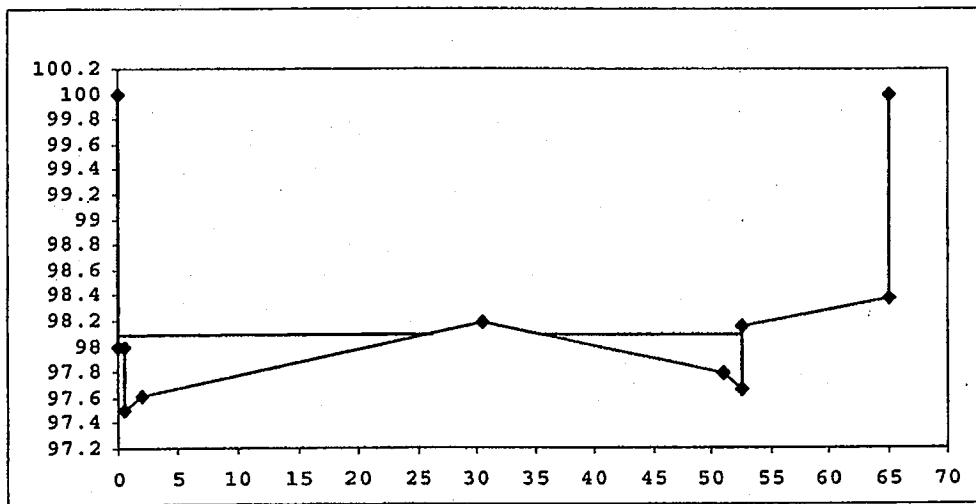
RESULTS

=====

Y= 98.10 FT
A= 9.76 SF
P= 44.57 FT
V= 1.36 FPS
F= 0.51 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

DIST	ELEV	COEFF
0	100.00	.016
0	98.00	.016
0.5	98.00	.016
0.5	97.50	.016
2	97.62	.016
30.5	98.19	.016
51	97.78	.016
52.5	97.66	.016
52.5	98.16	.016
65	98.37	.016
65	100.00	.016



BASIN #8 THIRD STREET (lowpoint south of Rincon Street)

Y - FLOW ELEVATION

Q - FLOWRATE

S - CHANNEL SLOPE

Q (CFS) ? 12.4

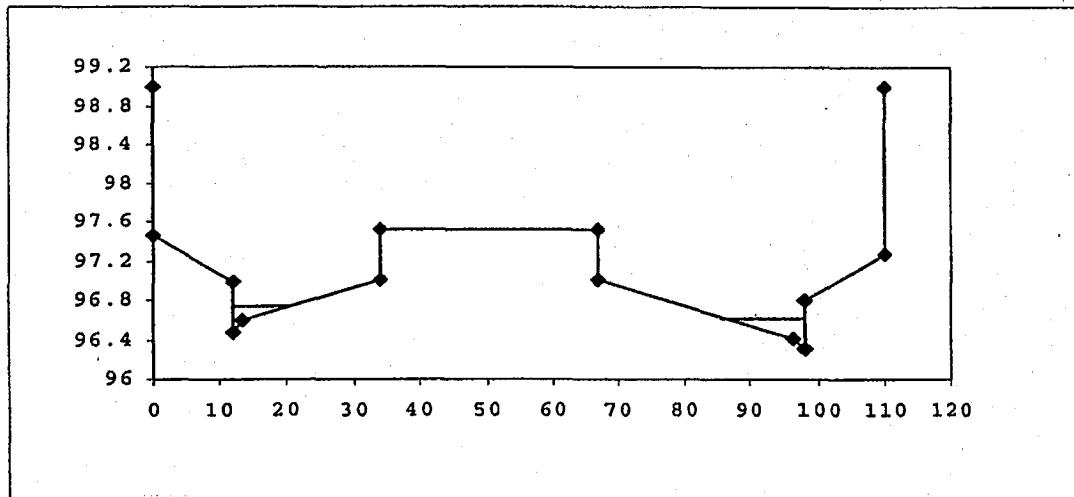
S (FT/FT) ? 0.007

RESULTS

=====

Y= 96.77 FT
A= 4.82 SF
P= 30.03 FT
V= 2.57 FPS
F= 1.12 SUPER-CRITICAL FLOW

CROSS-SECTION POINTS					
DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	99.00	.016	98	96.30	.016
0	97.46	.016	98	96.80	.016
12	96.98	.016	110	97.28	.016
12	96.48	.016	110	99.00	.016
13.5	96.60	.016			
34	97.01	.016			
34	97.51	.016			
67	97.51	.016			
67	97.01	.016			
96.5	96.42	.016			



SEPARATED STORM DRAIN ANALYSIS
for the
MISSION BAY PROJECT

Based on the
5 Year Design Storm

Prepared for :



CATELLUS

FEBRUARY 11, 2000



Given: The 5 year design storm as defined in the *Mission Bay Subdivision Regulations* dated 1998.

Analyze: Each of five separated storm drain systems proposed for the Mission Bay project to confirm that the hydraulic grade line is no less than one foot below pavement or ground surfaces in conformance with the *Mission Bay Subdivision Regulations* dated 1998. Systems are labeled M, B, C, D, & E (M system was labeled based on the existing designation for the Mariposa system.)

Watersheds: Tributary areas for each node of the system are as proposed on the *Watershed Map for Separated Storm Drain System* dated February 11, 2000. The watershed map indicates the proposed tributary area for each node. Watersheds are identified by the designation of the included node.

Standards: All calculations are in accordance with Section XVIII "Required Capacity of Separated Storm Drain System" of the *Mission Bay Subdivision Regulations* dated 1998.

Hydraulic Grade Line: Because all 5 storm drain systems terminate at pumping facilities, the starting hydraulic grade line (HGL) elevation for each system is set at the critical depth of flow in the inlet to the pump station. The *Mission Bay Subdivision Regulations* dated 1998 require a minimum freeboard of 1.0 feet inlet rims. Rim elevations used are equal to the final (50 year settlement) grades, as established on the *Conceptual Grading Plan* prepared by Santina & Thompson Inc. and Hawk Engineers Inc. dated February 11, 2000, less 0.5 ft, to approximate the flowline elevation of the adjacent gutter. Because final (50 year settlement) grades are always equal to or lower than initial (pre-settlement) grades, only final grades have been considered in determining minimum freeboard.

Calculations: All calculations were performed using Haestad Methods "StormCAD v3.0". Hydrology calculations are performed using the Rational Method and hydraulics calculations are performed using Manning's Equation.

Intensities: 5 Year rainfall intensities are taken from the tabulation entitled "San Francisco Rainfall Rate Table 1941" Plan L-3903.4 dated February 1941, and subsequent revisions. 5 Year rainfall intensities are as follows:

5 Year Rainfall Intensities

<u>Time (min)</u>	<u>Intensity (in/hr)</u>	<u>Time (min)</u>	<u>Intensity (in/hr)</u>
5	3.126	45	0.856
6	2.922	50	0.805
7	2.742	55	0.762
10	2.316	60	0.723
15	1.840	65	0.690
20	1.526	70	0.661
25	1.303	75	0.635
30	1.137	80	0.611
35	1.009	85	0.590
40	0.918	90	0.570

Coefficient: Table 1 "Coefficients of Run-Off and Inlet Times" contained in the Mission bay Subdivision Regulations requires a coefficient of 0.80 to 0.96 for "commercial" areas. A coefficient of 0.85 has been selected based on the future development of the area. A coefficient of 0.80 has been used in watersheds containing park land.

**Hydraulic
Model:**

Some large upstream pipes contain very low calculated flows which result in correspondingly low velocities. The Rational Method of Analysis is sensitive to system time, thus these low velocities would result in unrealistic system flows. In order to overcome the effect of very low calculated velocities, pipe sizes, in some cases, were artificially reduced; or fictitious flows were added and subsequently subtracted at downstream nodes. Some very small watersheds were eliminated for the same reason. These modifications to the hydraulic model are documented on the enclosed calculations. Fictitious flows are listed in the "Additional Flow" column of the Node Information Table. Any pipe size below 18-inches in diameter was used for calculation purposes only. The actual pipe size would remain as indicated on the Separated Storm Drain System Map.

Pipe Information Table
Area M
5 Year Storm

Label	Up-stream Node	Section Size	Mannings n	Length (ft)	Con-structed Slope (ft/ft)	Upstream Invert Elevation (ft)	Down-stream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Down-stream Ground Elevation (ft)	Hydraulic Grade In (feet)	Hydraulic Grade Out (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Up-stream Cover (ft)	Down-stream Cover (ft)	Upstream Freeboard (feet)
P-1	M-1	18 inch	0.014	230.5	0.001735	97.6	97.2	103.1	103	100.6	100.32	3.43	1.94	4	4.3	2.5
P-2	M-2	24 inch	0.014	380	0.006053	97.2	94.9	103	101.9	100.29	100.13	4.32	1.37	3.8	5	2.7
P-3	M-3	42 inch	0.014	496.5	0.001611	94.9	94.1	101.9	102.7	99.94	99.31	33.28	3.46	3.5	5.1	2.0
P-4	M-4	48 inch	0.014	530	0.001132	94.1	93.5	102.7	103.5	99.14	98.62	41.82	3.33	4.6	6	3.6
P-5	M-5	48 inch	0.014	242.5	0.004124	93.5	92.5	103.5	100.3	98.37	98.03	50.19	3.99	6	3.8	5.1
P-6	M-6	48 inch	0.014	289.5	0	92.5	92.5	100.3	100.2	97.67	97.07	60.45	4.81	3.8	3.7	2.6
P-7	M-7	48 inch	0.014	255	0.000392	92.5	92.4	100.2	100.2	96.68	96.13	62.75	5.03	3.7	3.8	3.5
P-8	M2-1	18 inch	0.014	156	0.012821	96.9	94.9	101.1	101.9	100.15	100.13	1.21	0.68	2.7	5.5	1.0
P-9	M1-3	30 inch	0.014	269.5	0.008163	97.1	94.9	103.1	101.9	101.09	100.13	22.83	4.65	3.5	4.5	2.0
P-10	M1-2	30 inch	0.014	281.5	0.002131	97.7	97.1	104.7	103.1	101.69	101.43	11.53	2.35	4.5	3.5	3.0
P-11	M1-1	18 inch	0.014	249	0.002008	98.2	97.7	114.9	104.7	102.19	101.77	4	2.26	15.2	5.5	12.7
P-12	M4-1	18 inch	0.014	141	0.009929	95.5	94.1	103.8	102.7	99.38	99.31	2.2	1.25	6.8	7.1	4.4
P-13	M3-4	24 inch	0.014	219.5	0.005011	95.2	94.1	103.2	102.7	99.7	99.31	8.83	2.81	6	6.6	3.5
P-14	M3-3	24 inch	0.014	212	0.005189	96.3	95.2	103.6	103.2	99.99	99.82	5.95	1.9	5.3	6	3.6
P-15	M3-2	18 inch	0.014	189.5	0.004749	97.2	96.3	104	103.6	100.36	100.05	3.95	2.23	5.3	5.8	3.6
P-16	M3-1	18 inch	0.014	201	0.004975	98.2	97.2	110.7	104	100.58	100.43	2.64	1.5	11	5.3	10.1
P-17	M6-1	18 inch	0.014	175.5	0.003989	94.2	93.5	103	103.5	98.76	98.62	2.74	1.55	7.3	8.5	4.2
P-18	M5-3	24 inch	0.014	329.5	0.003945	94.8	93.5	103.9	103.5	99.46	98.62	10.61	3.38	7.1	8	4.4
P-19	M5-2	24 inch	0.014	291	0.004124	96	94.8	104	103.9	100.04	99.63	7.82	2.49	6	7.1	4.0
P-20	M5-1	18 inch	0.014	251.5	0.003976	97	96	105.3	104	100.45	100.13	3.45	1.95	6.8	6.5	4.8
P-21	M7-3	36 inch	0.014	396	0.00303	93.7	92.5	100.2	100.3	98.13	98.03	9.88	1.4	3.5	4.8	2.1
P-22	M7-2	24 inch	0.014	324	0.003086	94.7	93.7	100.1	100.2	98.47	98.16	6.52	2.07	3.4	4.5	1.6
P-23	M7-1	18 inch	0.014	184	0.002717	95.2	94.7	100.1	100.1	98.79	98.54	3.64	2.06	3.4	3.9	1.3
P-24	M-8	54 inch	0.014	119	0.00084	92.4	92.3	100.2	100.7	95.56	94.78	72.43	6.68	3.3	3.9	4.6
P-25	M9-4	30 inch	0.014	114.5	0.001747	92.6	92.4	100.2	100.2	96.36	96.13	17.15	3.49	5.1	5.3	3.8
P-26	M9-3	36 inch	0.014	252	0.001984	93.1	92.6	100	100.2	96.7	96.55	14.97	2.12	3.9	4.6	3.3
P-27	M9-2	24 inch	0.014	239	0.002092	93.6	93.1	99.9	100	97.36	96.77	10.39	3.31	4.3	4.9	2.5
P-28	M9-1	24 inch	0.014	276	0.002174	94.2	93.6	100.1	99.9	97.73	97.53	5.76	1.83	3.9	4.3	2.4
P-29	M8-2	24 inch	0.014	71	0.005634	92.8	92.4	100.2	100.2	96.2	96.13	6.43	2.05	5.4	5.8	4.0
P-30	M8-1	18 inch	0.014	224.5	0.0049	93.9	92.8	99.8	100.2	96.35	96.26	1.89	1.07	4.4	5.9	3.5

February 11, 2000

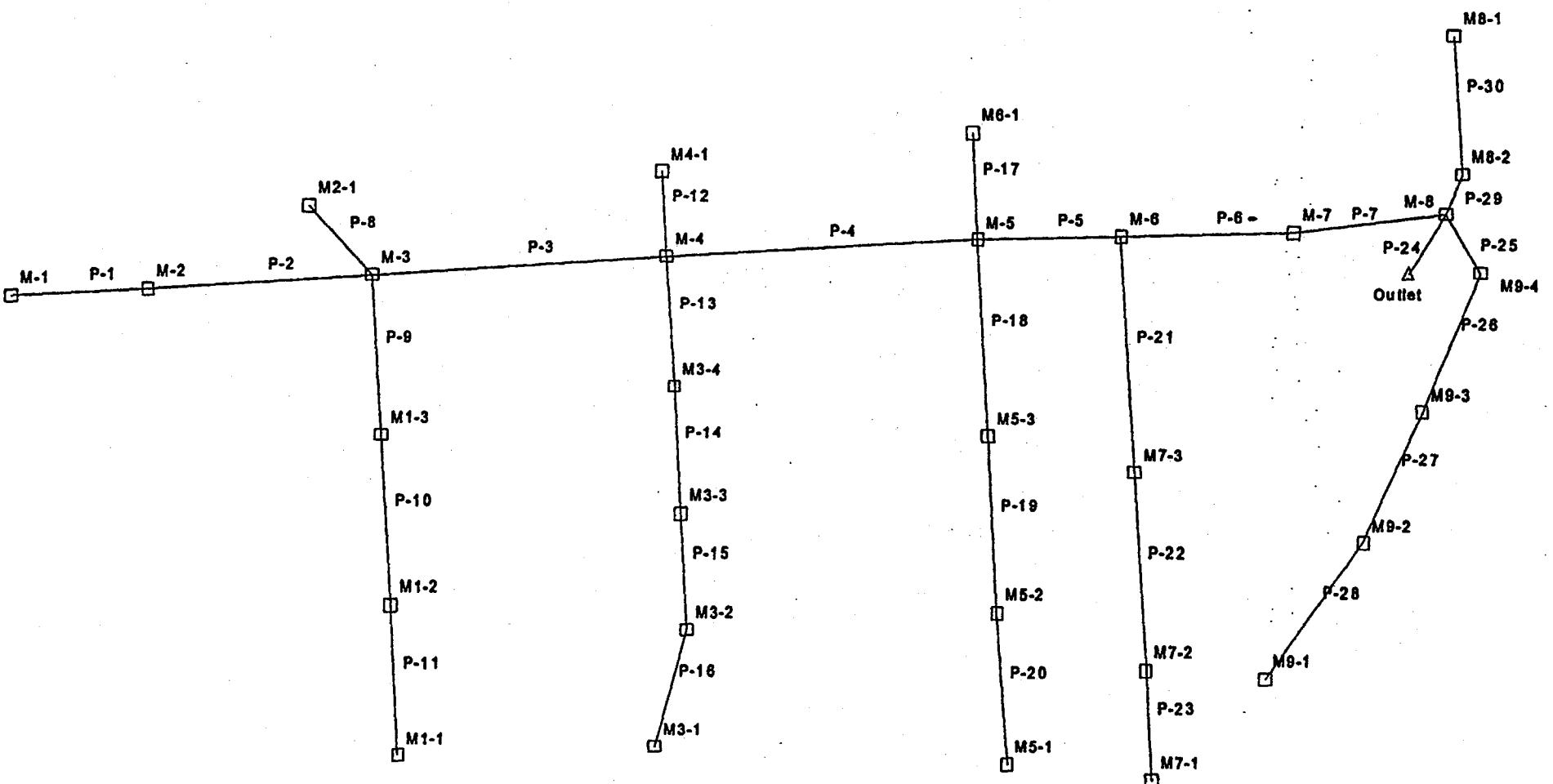
Node Information Table

Area M

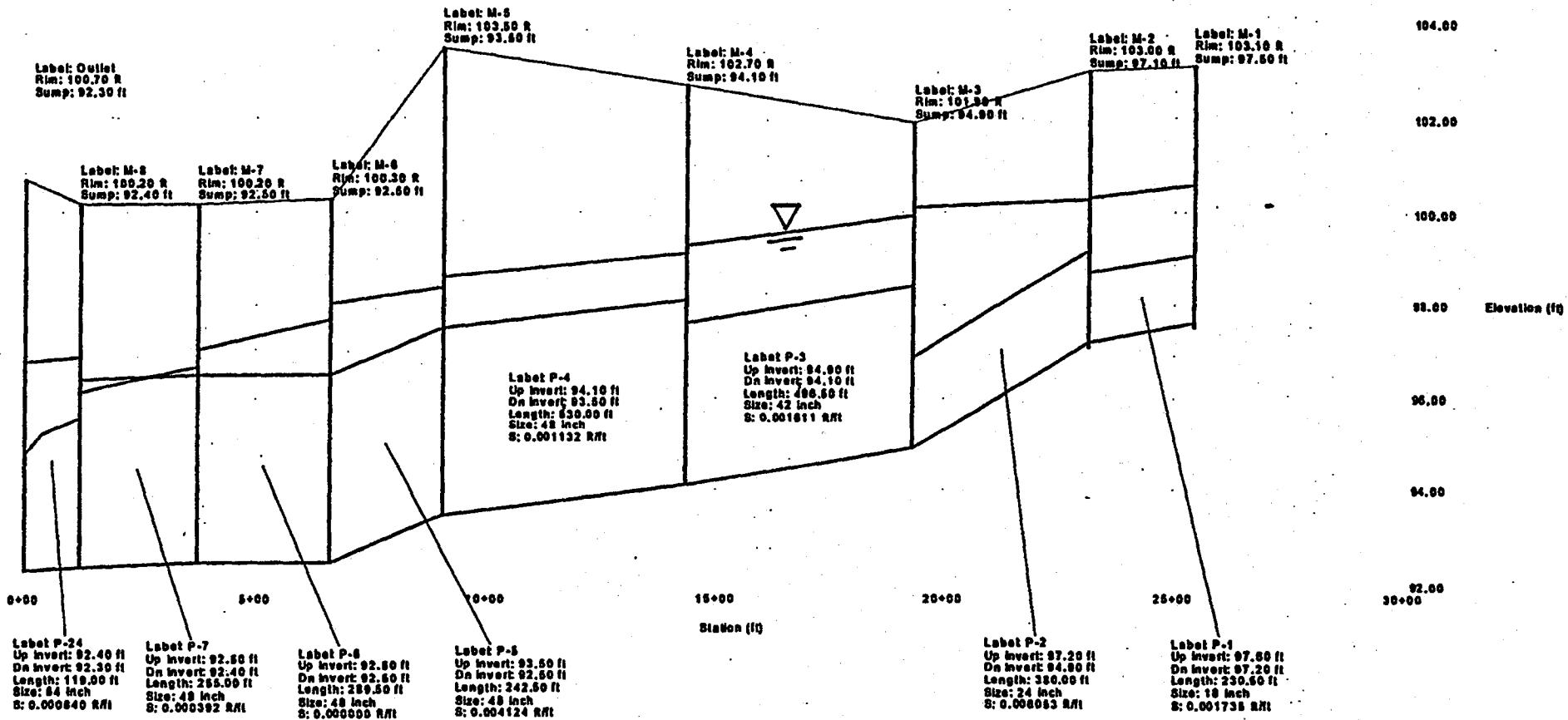
5 Year Storm

Node	Inlet Area (acres)	Inlet C Coefficient	Inlet CA (acres)	System Contributing Area (acres)	Ex-ternal Tc (min)	System Flow Time (min)	System In-tensity (in/hr)	System Rational Flow (cfs)	Ad-ditional Flow (cfs)	Total System Flow (cfs)	Local In-tensity (in/hr)	Local Rational Flow (cfs)	HGL In (ft)	HGL Out (ft)	Rim Elevation (ft)
M-1	0.16	0.85	0.14	0.14	0	5	3.13	0.43	3	3.43	3.13	0.43	100.7	100.6	103.1
M-2	0.4	0.85	0.34	0.48	0	6.98	2.74	1.32	0	4.32	4.18	1.43	100.3	100.29	103
M-3	6.18	0.85	5.25	15.23	0	11.59	2.17	33.28	-3	33.28	4.18	22.13	100.1	99.94	101.9
M-4	2.88	0.85	2.45	21.41	0	13.98	1.94	41.82	-2	41.82	4.18	10.31	99.31	99.14	102.7
M-5	1.49	0.85	1.27	29.79	0	17.72	1.67	50.19	0	50.19	4.18	5.34	98.62	98.37	103.5
M-6	3.36	0.85	2.86	35.44	0	18.74	1.61	57.45	0	60.45	4.18	12.03	98.03	97.67	100.3
M-7	3.41	0.85	2.9	38.34	0	19.74	1.55	59.75	0	62.75	4.18	12.21	97.07	96.68	100.2
M-8	0.84	0.85	0.71	47.8	0	20.58	1.5	72.43	-6	72.43	4.18	3.01	96.13	95.56	100.2
M1-1	1.49	0.85	1.27	1.27	0	5	3.13	4	0	4	3.13	4	102.3	102.19	114.9
M1-2	3.37	0.85	2.86	4.13	0	6.84	2.77	11.53	0	11.53	3.13	9.04	101.8	101.69	104.7
M1-3	5.87	0.85	4.99	9.12	0	8.83	2.48	22.83	0	22.83	3.13	15.74	101.4	101.09	103.1
M2-1	0.45	0.85	0.38	0.38	0	5	3.13	1.21	0	1.21	3.13	1.21	100.2	100.15	101.1
M3-1	0.24	0.85	0.2	0.2	0	5	3.13	0.64	2	2.64	3.13	0.64	100.6	100.58	110.7
M3-2	0.6	0.85	0.51	0.71	0	7.24	2.71	1.95	0	3.95	4.18	2.15	100.4	100.36	104
M3-3	1	0.85	0.85	1.56	0	8.65	2.51	3.95	0	5.95	4.18	3.58	100.1	99.99	103.6
M3-4	1.67	0.85	1.42	2.98	0	10.52	2.27	6.83	0	8.83	4.18	5.98	99.82	99.7	103.2
M4-1	0.88	0.85	0.75	0.75	0	6	2.92	2.2	0	2.2	2.92	2.2	99.41	99.38	103.8
M5-1	1.89	0.85	1.61	1.61	0	12	2.13	3.45	0	3.45	2.13	3.45	100.5	100.45	105.3
M5-2	2.86	0.85	2.43	4.04	0	14.15	1.92	7.82	0	7.82	4.18	10.24	100.1	100.04	104
M5-3	2.24	0.85	1.9	5.94	0	16.1	1.77	10.61	0	10.61	4.18	8.02	99.63	99.46	103.9
M6-1	1.38	0.85	1.17	1.17	0	10	2.32	2.74	0	2.74	2.32	2.74	98.79	98.76	103
M7-1	0.24	0.85	0.2	0.2	0	5	3.13	0.64	3	3.64	3.13	0.64	98.86	98.79	100.1
M7-2	1.21	0.85	1.03	1.23	0	6.49	2.83	3.52	0	6.52	4.18	4.33	98.54	98.47	100.1
M7-3	1.83	0.85	1.56	2.79	0	9.09	2.45	6.88	0	9.88	4.18	6.55	98.16	98.13	100.2
M8-1	0.75	0.8	0.6	0.6	0	5	3.13	1.89	0	1.89	3.13	1.89	96.37	96.35	99.8
M8-2	2.4	0.8	1.92	2.52	0	8.49	2.53	6.43	0	6.43	4.18	8.09	96.26	96.2	100.2
M9-1	1.03	0.85	0.88	0.88	0	5	3.13	2.76	3	5.76	3.13	2.76	97.79	97.73	100.1
M9-2	2.2	0.85	1.87	2.75	0	7.51	2.67	7.39	0	10.39	4.18	7.88	97.53	97.36	99.9
M9-3	2.36	0.85	2.01	4.75	0	8.71	2.5	11.97	0	14.97	4.18	8.45	96.77	96.7	100
M9-4	1.74	0.85	1.48	6.23	0	10.7	2.25	14.15	0	17.15	4.18	6.23	96.55	96.36	100.2
Out				47.8		20.88	1.49	21.77		71.77			94.78	94.78	100.7

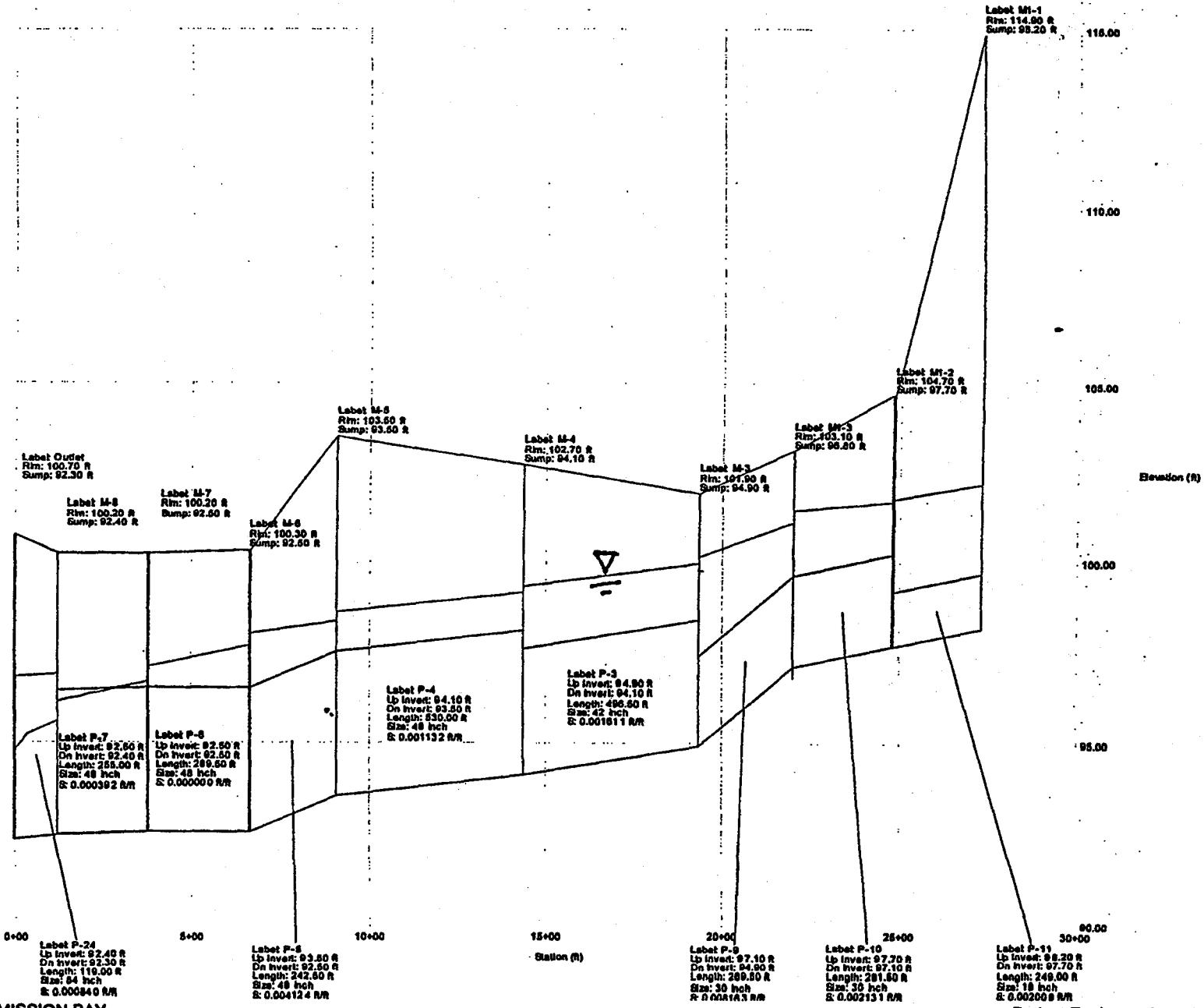
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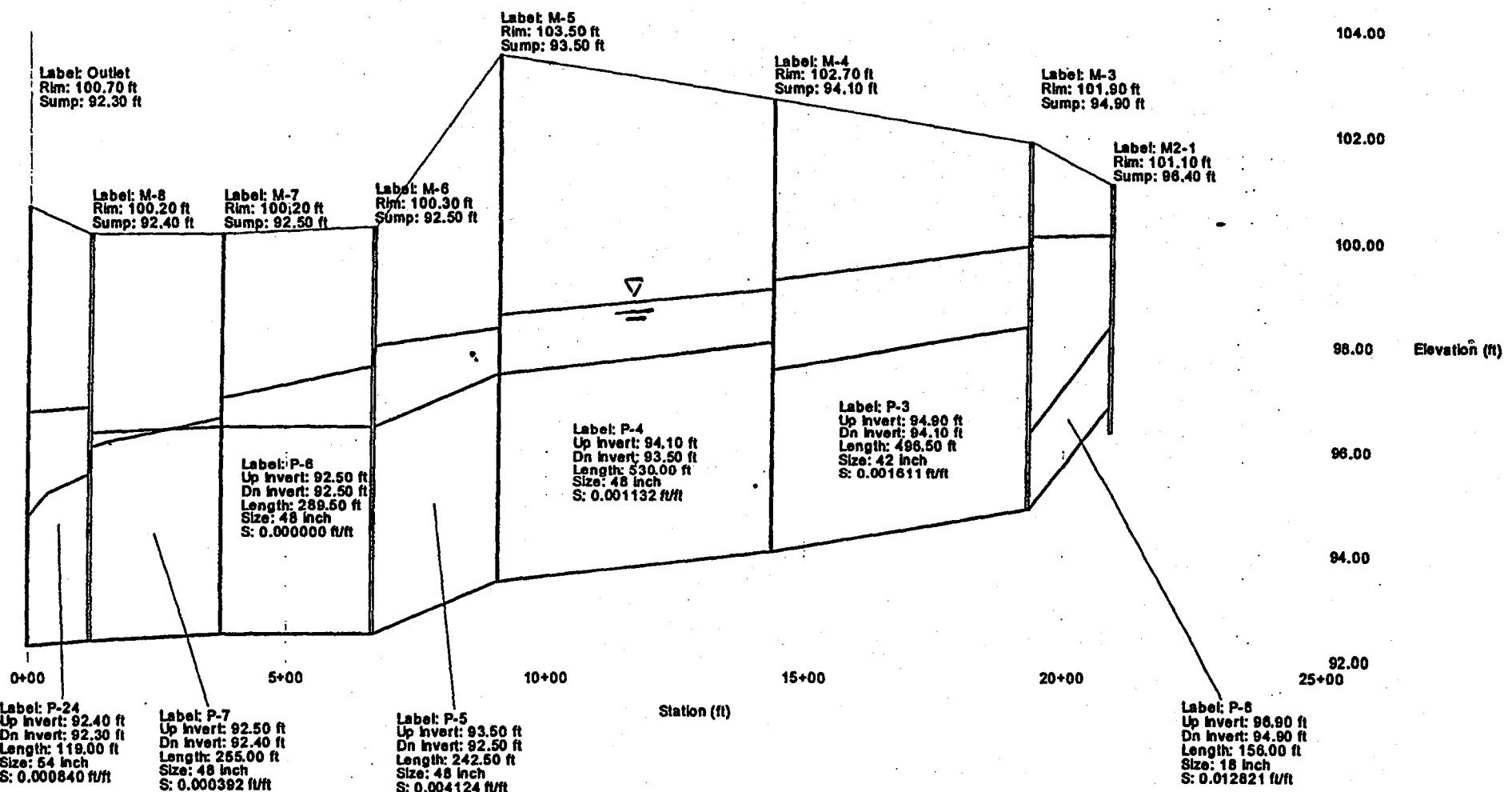
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Scenario: Base



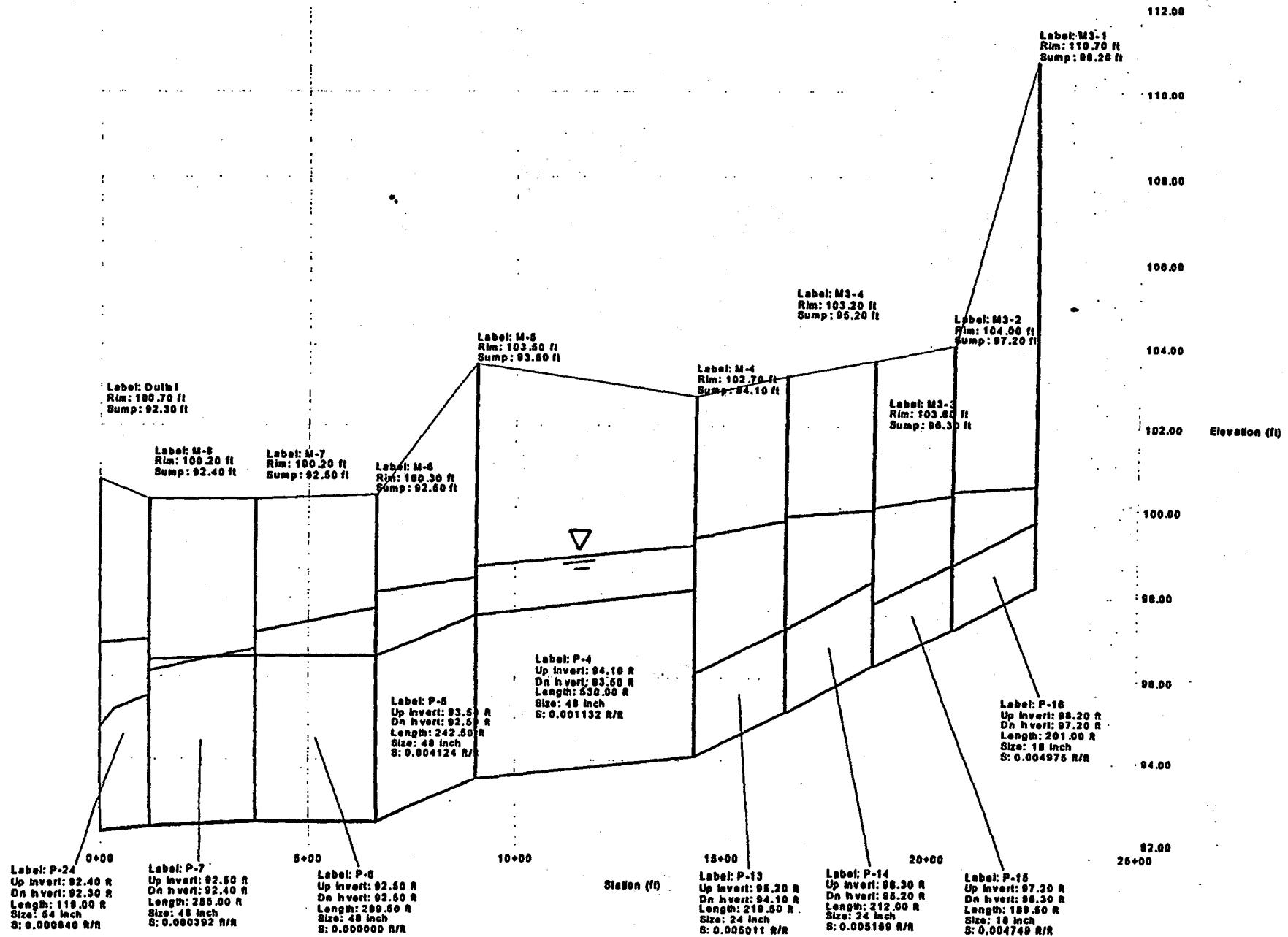
**Profile
Scenario: Base**



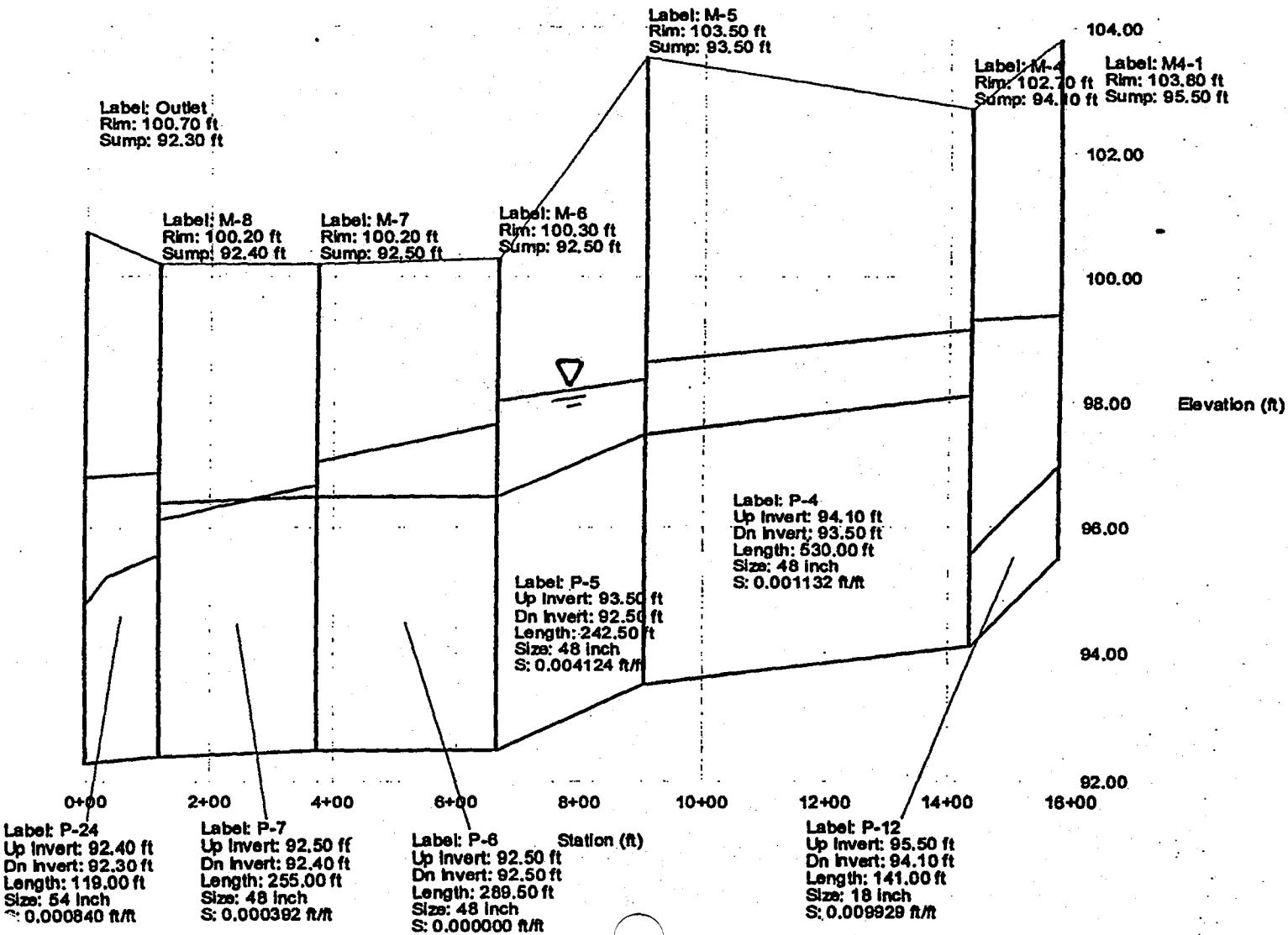
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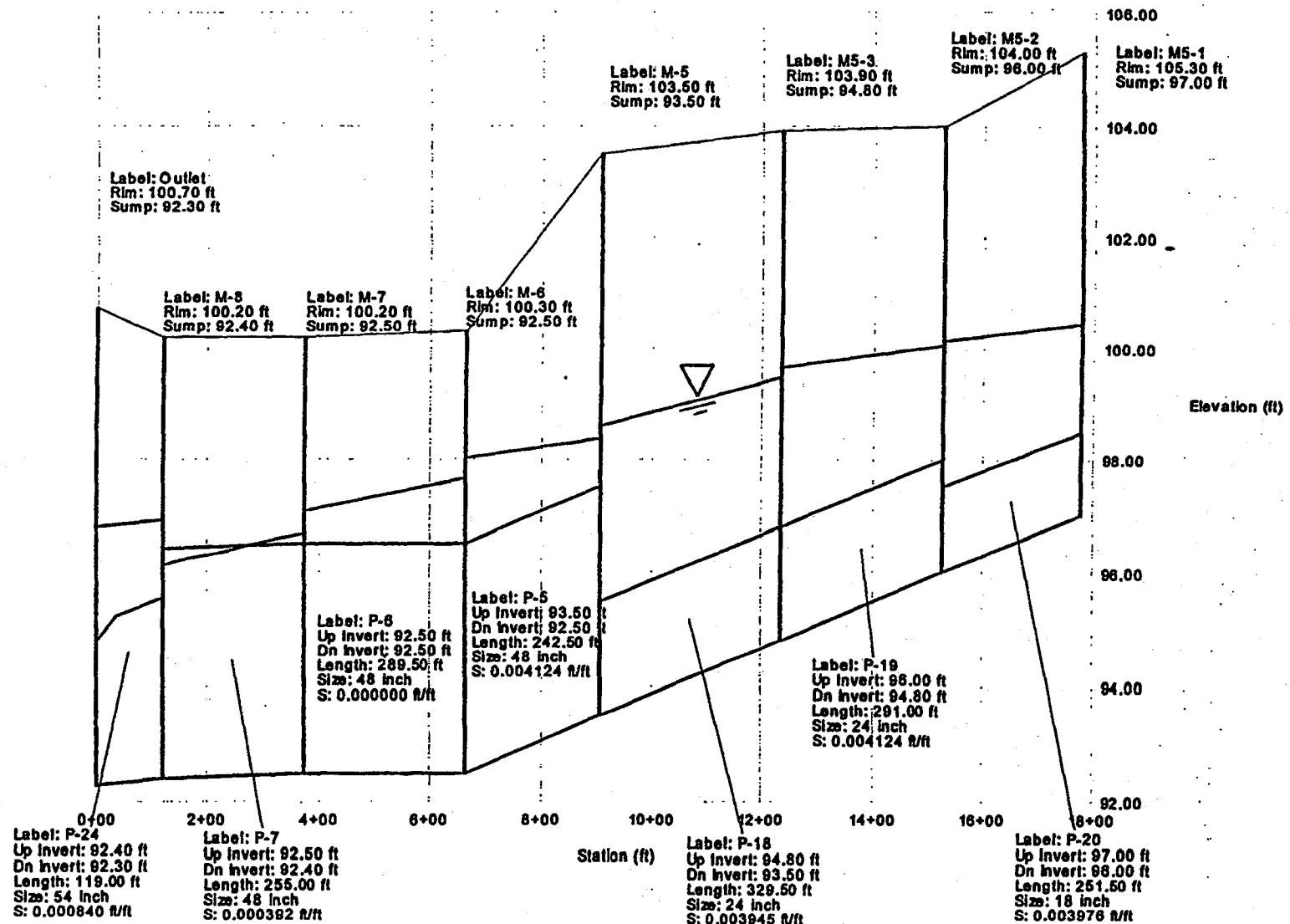
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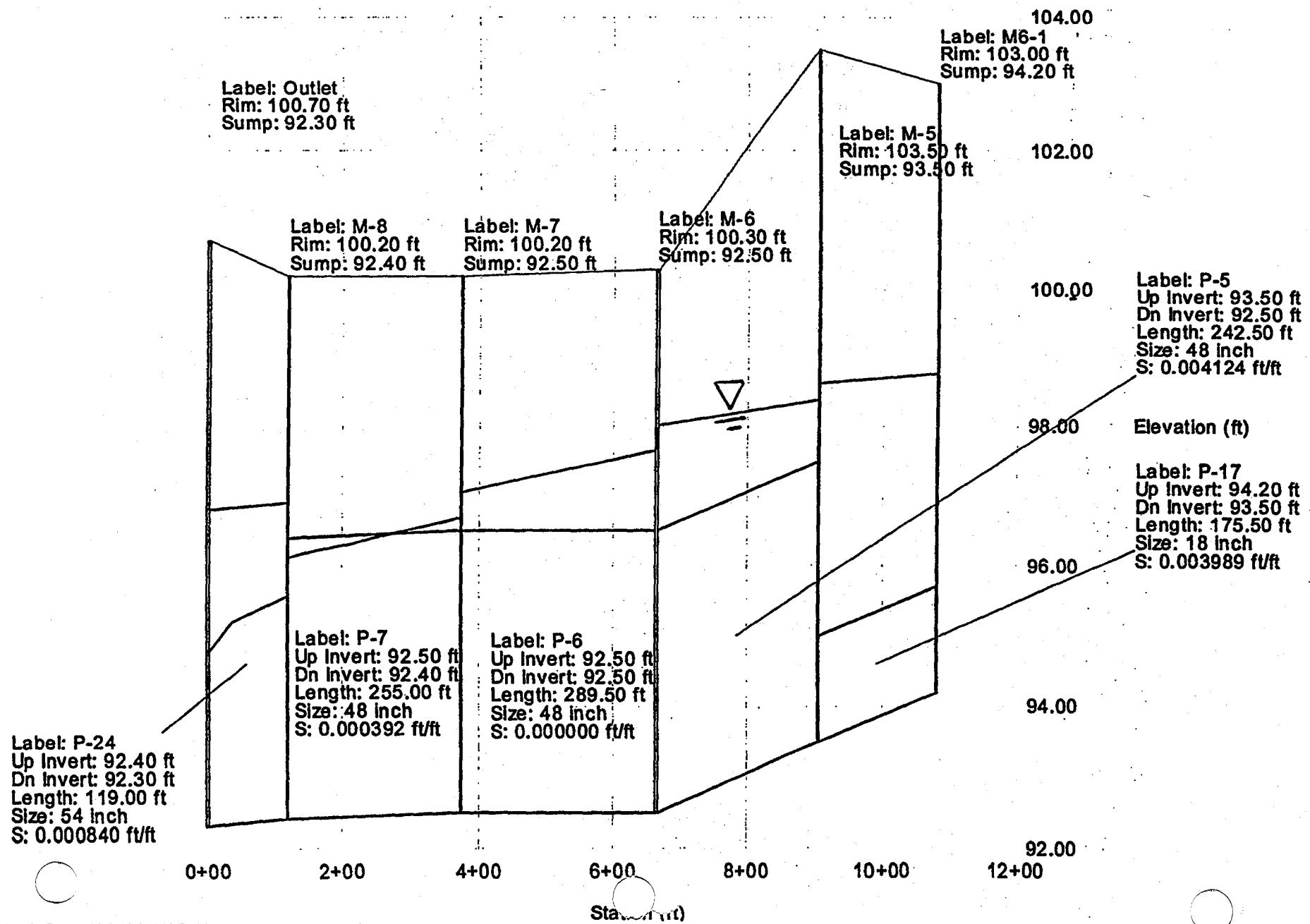
Profile
Scenario: Base



Profile
Scenario: Base



Profile
Scenario: Base



Profile

Scenario: Base

Label: Outlet
Rim: 100.70 ft
Sump: 92.30 ft

Label: M-8
Rim: 100.20 ft
Sump: 92.40 ft

Label: M-7
Rim: 100.20 ft
Sump: 92.50 ft

Label: M-6
Rim: 100.30 ft
Sump: 92.50 ft

Label: M7-3
Rim: 100.20 ft
Sump: 93.70 ft

Label: M7-1
Rim: 100.10 ft
Sump: 95.20 ft

101.00

100.00

99.00

98.00

97.00

96.00

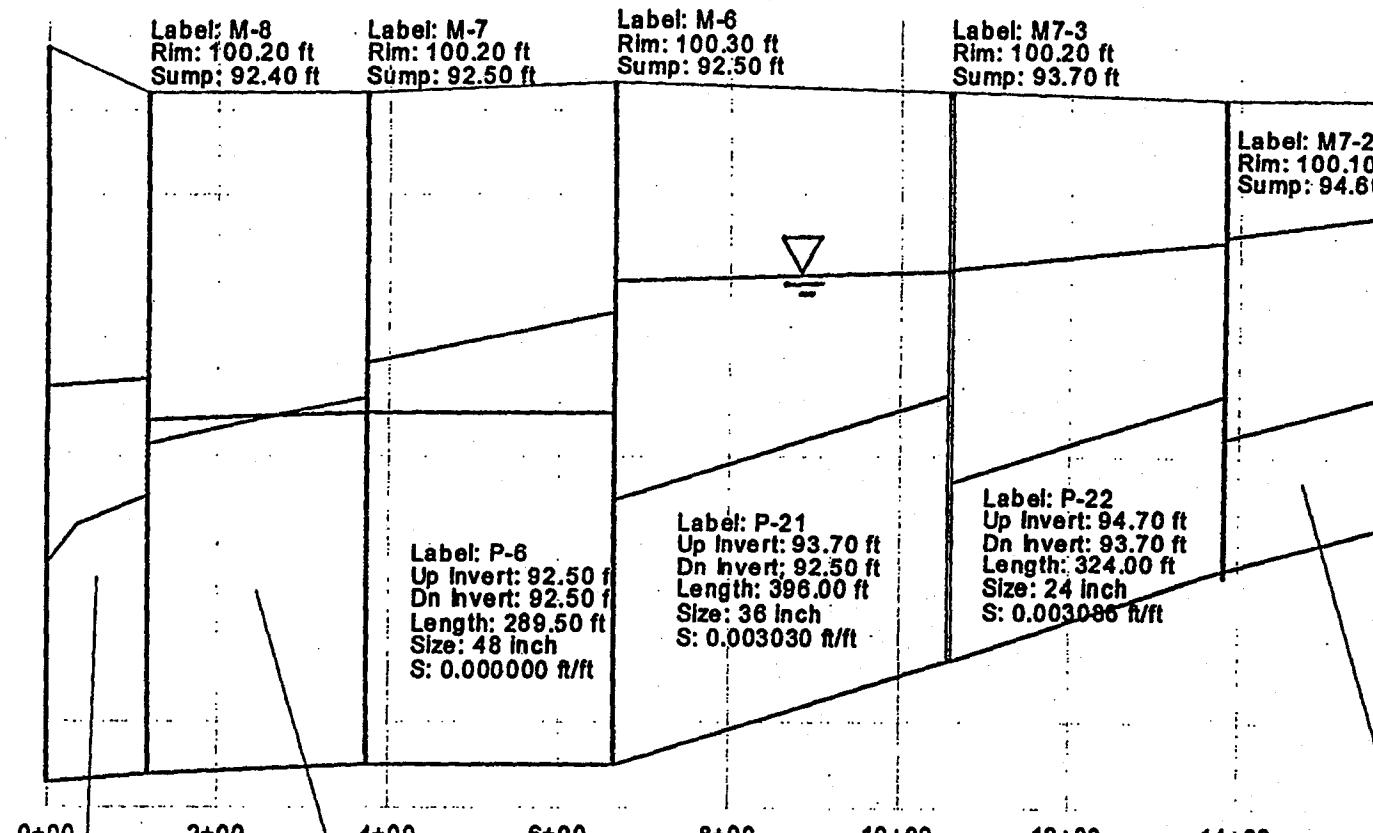
95.00

94.00

93.00

92.00

Elevation (ft)



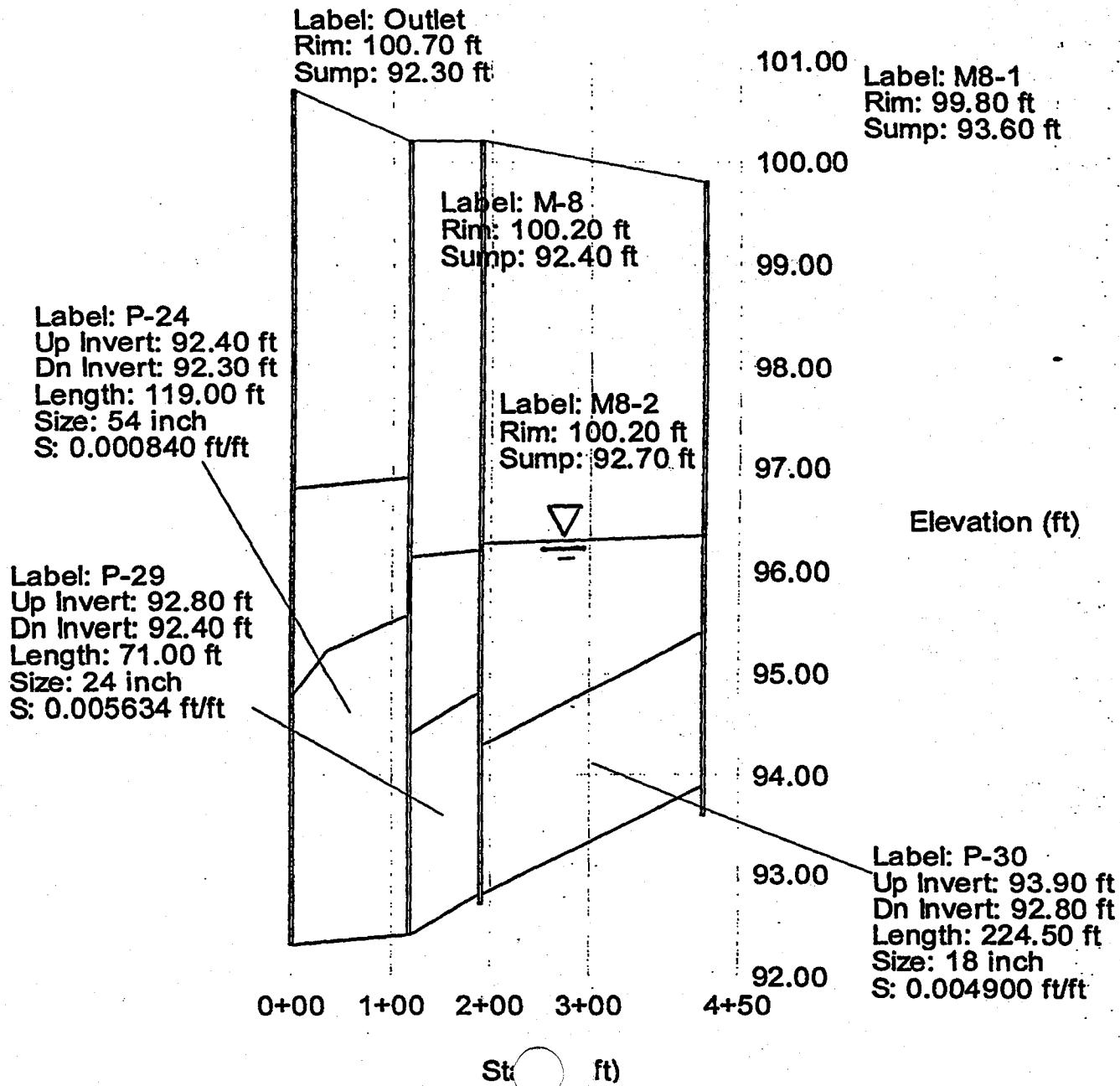
Label: P-24
Up Invert: 92.40 ft
Dn Invert: 92.30 ft
Length: 119.00 ft
Size: 54 inch
S: 0.000840 ft/ft

Label: P-7
Up Invert: 92.50 ft
Dn Invert: 92.40 ft
Length: 255.00 ft
Size: 48 inch
S: 0.000392 ft/ft

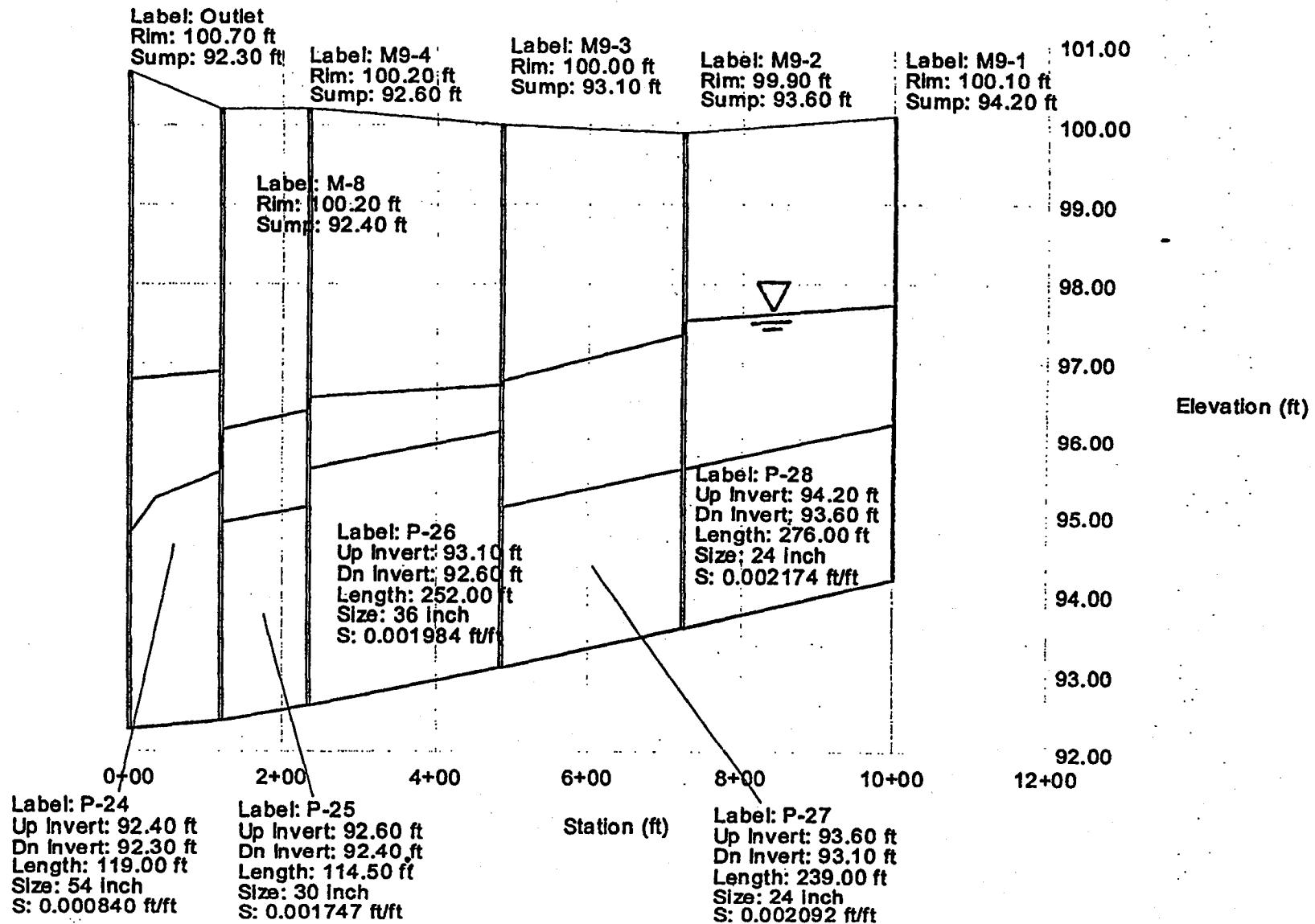
Station (ft)

Label: P-23
Up Invert: 95.20 ft
Dn Invert: 94.70 ft
Length: 184.00 ft
Size: 18 inch
S: 0.002717 ft/ft

Profile
Scenario: Base



Profile
Scenario: Base



Pipe Information Table

Area B

5 Year Storm

Label	Up-stream Node	Section Size	Mannings n	Length (ft)	Con-structed Slope (ft/ft)	Upstream Invert Elevation (ft)	Down-stream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Down-stream Ground Elevation (ft)	Hydraulic Grade In (feet)	Hydraulic Grade Out (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Up-stream Cover (ft)	Down-stream Cover (ft)	Upstream Freeboard (feet)
P-1	B-1	24 inch	0.014	190	0.003684	95.2	94.5	102	101.4	96.18	95.94	5.79	3.07	4.8	4.9	5.8
P-2	B-2	30 inch	0.014	227	0.003965	94.5	93.6	101.4	100.5	95.61	95.11	9.72	4.11	4.4	4.4	5.8
P-3	B-3	36 inch	0.014	245.5	0.004073	93.6	92.6	100.5	100.1	94.74	94.54	12.07	3.59	3.9	4.5	5.8
P-4	B-4	36 inch	0.014	347.5	0.004029	92.6	91.2	100.1	99.5	94.07	93.55	18.96	4.41	4.5	5.3	6.0
P-5	B-5	42 inch	0.014	287	0.004181	91.2	90	99.5	98.7	93.17	93.01	27.47	3.86	4.8	5.2	6.3
P-6	B-6	48 inch	0.014	134.5	0.003717	90	89.5	98.7	99.2	92.29	91.64	50.72	6.92	4.7	5.7	6.4
P-7	B1-1	18 inch	0.014	171	0.009942	94.4	92.7	99.8	99.6	95.09	93.79	3.31	4.59	3.9	5.4	4.7
P-8	B1-2	24 inch	0.014	153	0.009804	92.7	91.2	99.6	99.5	93.5	93.55	5.1	2.23	4.9	6.3	6.1
P-9	B2-1	12 inch	0.014	222.5	0.004944	95.1	94	101.5	100.1	97.79	96.66	2.63	3.09	5.36	5.06	3.7
P-10	B2-2	21 inch	0.014	324	0.004938	94	92.4	100.1	98	96.48	95.46	8.24	3.43	4.35	3.85	3.6
P-11	B2-3	24 inch	0.014	217.5	0.001839	92.4	92	98	97.7	95.27	94.64	11.24	3.58	3.6	3.7	2.7
P-12	B2-4	30 inch	0.014	236.5	0.002114	92	91.5	97.7	97.5	94.53	94.26	12.96	2.64	3.2	3.5	3.2
P-13	B2-5	33 inch	0.014	231.5	0.001728	91.5	91.1	97.5	97.5	94.12	93.86	17.37	2.94	3.25	3.65	3.4
P-14	B2-6	33 inch	0.014	134.5	0.00223	91.1	90.8	97.5	97.5	93.7	93.53	18.71	3.18	3.65	3.95	3.8
P-15	B2-7	36 inch	0.014	398.5	0.002008	90.8	90	97.5	98.7	93.38	93.01	20.27	2.97	3.7	5.7	4.1

February 11, 2000

Node Information Table

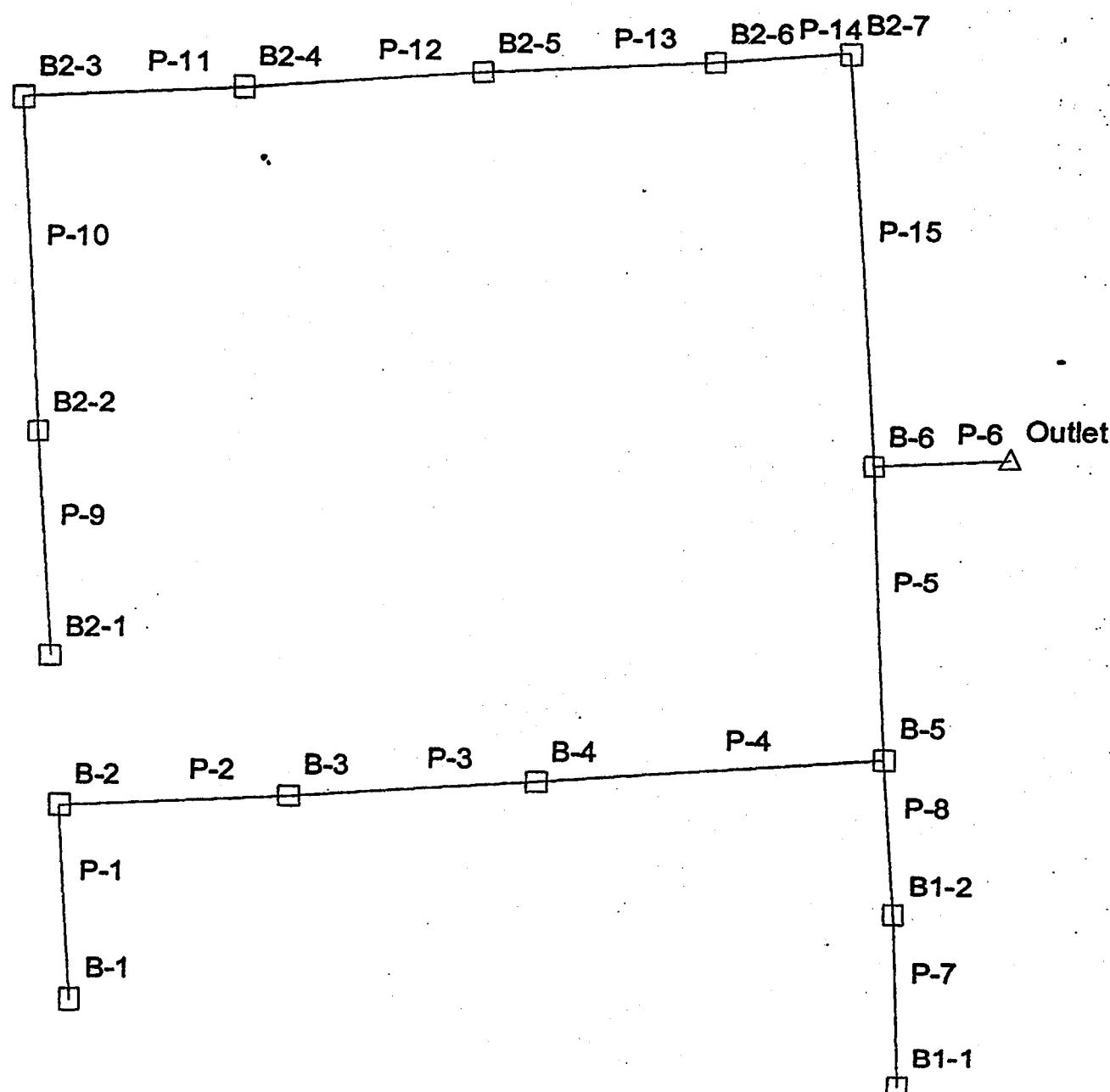
Area B

5 Year Storm

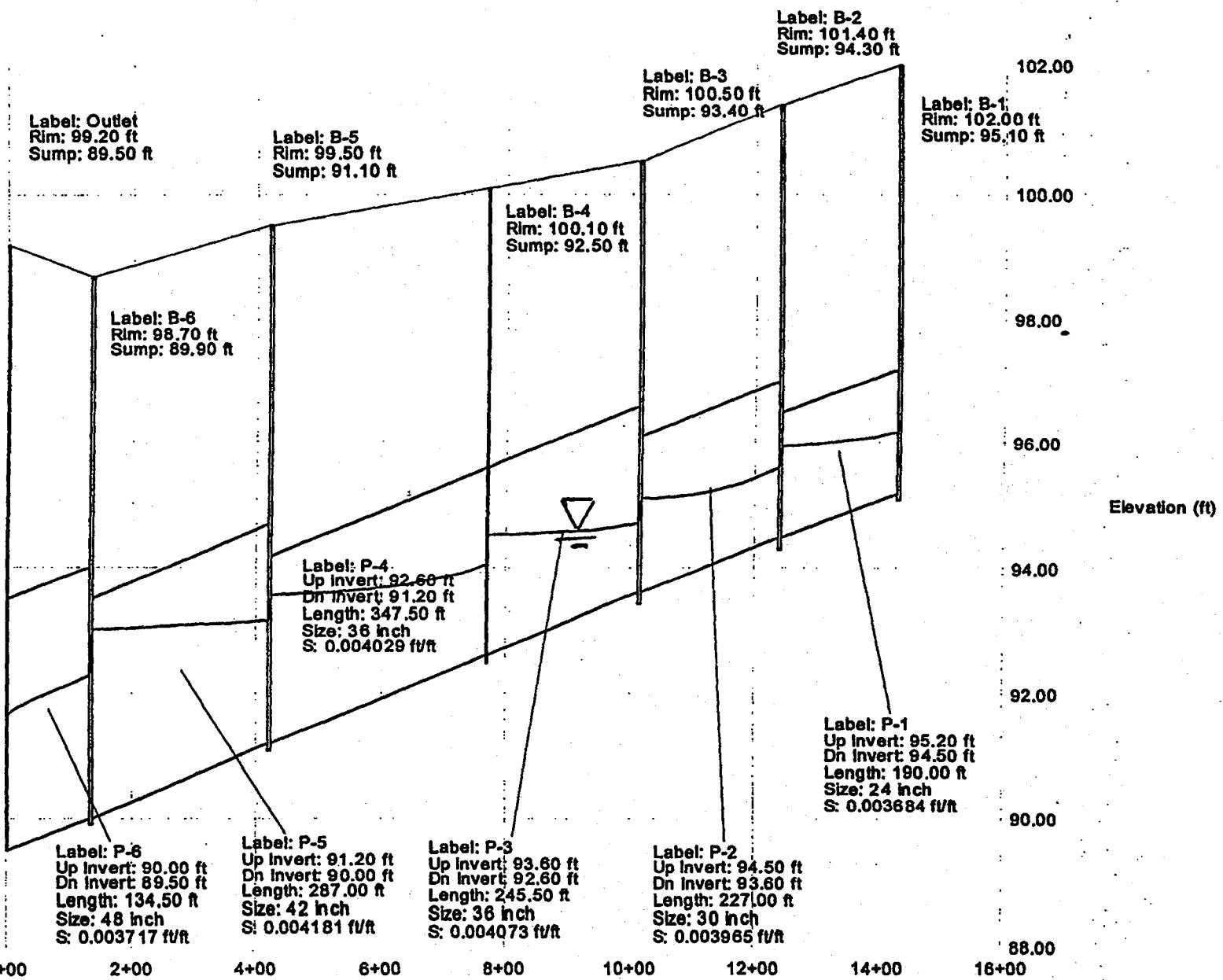
Node	Inlet Area (acres)	Inlet C Coefficient	Inlet CA (acres)	System Contributing Area (acres)	Ex- ternal Tc (min)	System Flow Time (min)	System In- tensity (in/hr)	System Rational Flow (cfs)	Ad- ditional Flow (cfs)	Total System Flow (cfs)	Local In- tensity (in/hr)	Local Rational Flow (cfs)	HGL In (ft)	HGL Out (ft)	Rim Elevation (ft)
B-1	3.49	0.85	2.97	2.97	0	14	1.94	5.79	0	5.79	1.94	5.79	96.4	96.18	102
B-2	2.68	0.85	2.28	5.24	0	15.03	1.84	9.72	0	9.72	4.18	9.6	95.94	95.61	101.4
B-3	1.74	0.85	1.48	6.72	0	15.95	1.78	12.07	0	12.07	4.18	6.23	95.11	94.74	100.5
B-4	5.03	0.85	4.28	11	0	17.09	1.71	18.96	0	18.96	4.18	18.01	94.54	94.07	100.1
B-5	3.8	0.8	3.04	16.73	0	18.41	1.63	27.47	0	27.47	4.18	12.81	93.55	93.17	99.5
B-6	6.43	0.8	5.14	32.42	0	19.65	1.55	50.72	0	50.72	4.18	21.67	93.01	92.29	98.7
B1-1	2.12	0.8	1.7	1.7	0	14	1.94	3.31	0	3.31	1.94	3.31	95.36	95.09	99.8
B1-2	1.25	0.8	1	2.7	0	14.62	1.88	5.1	0	5.1	4.18	4.21	93.79	93.5	99.6
B2-1	1.12	0.85	0.95	0.95	0	7	2.74	2.63	0	2.63	2.74	2.63	97.94	97.79	101.5
B2-2	2.62	0.85	2.23	3.18	0	8.2	2.57	8.24	0	8.24	4.18	9.38	96.66	96.48	100.1
B2-3	1.84	0.85	1.56	4.74	0	9.78	2.35	11.24	0	11.24	4.18	6.59	95.46	95.27	98
B2-4	1.16	0.85	0.99	5.73	0	10.79	2.24	12.96	0	12.96	4.18	4.15	94.64	94.53	97.7
B2-5	2.91	0.85	2.47	8.2	0	12.28	2.1	17.37	0	17.37	4.18	10.42	94.26	94.12	97.5
B2-6	1.41	0.85	1.2	9.4	0	13.6	1.97	18.71	0	18.71	4.18	5.05	93.86	93.7	97.5
B2-7	1.43	0.8	1.14	10.55	0	14.3	1.91	20.27	0	20.27	4.18	4.82	93.53	93.38	97.5
Outlet				32.42		19.97	1.53	50.06		50.06			91.64	91.64	99.2

February 11, 2000

Scenario: Base



Profile Scenario: Base



0+00

2+00

4+00

6+00

8+00

10+0

12+6

14+

164

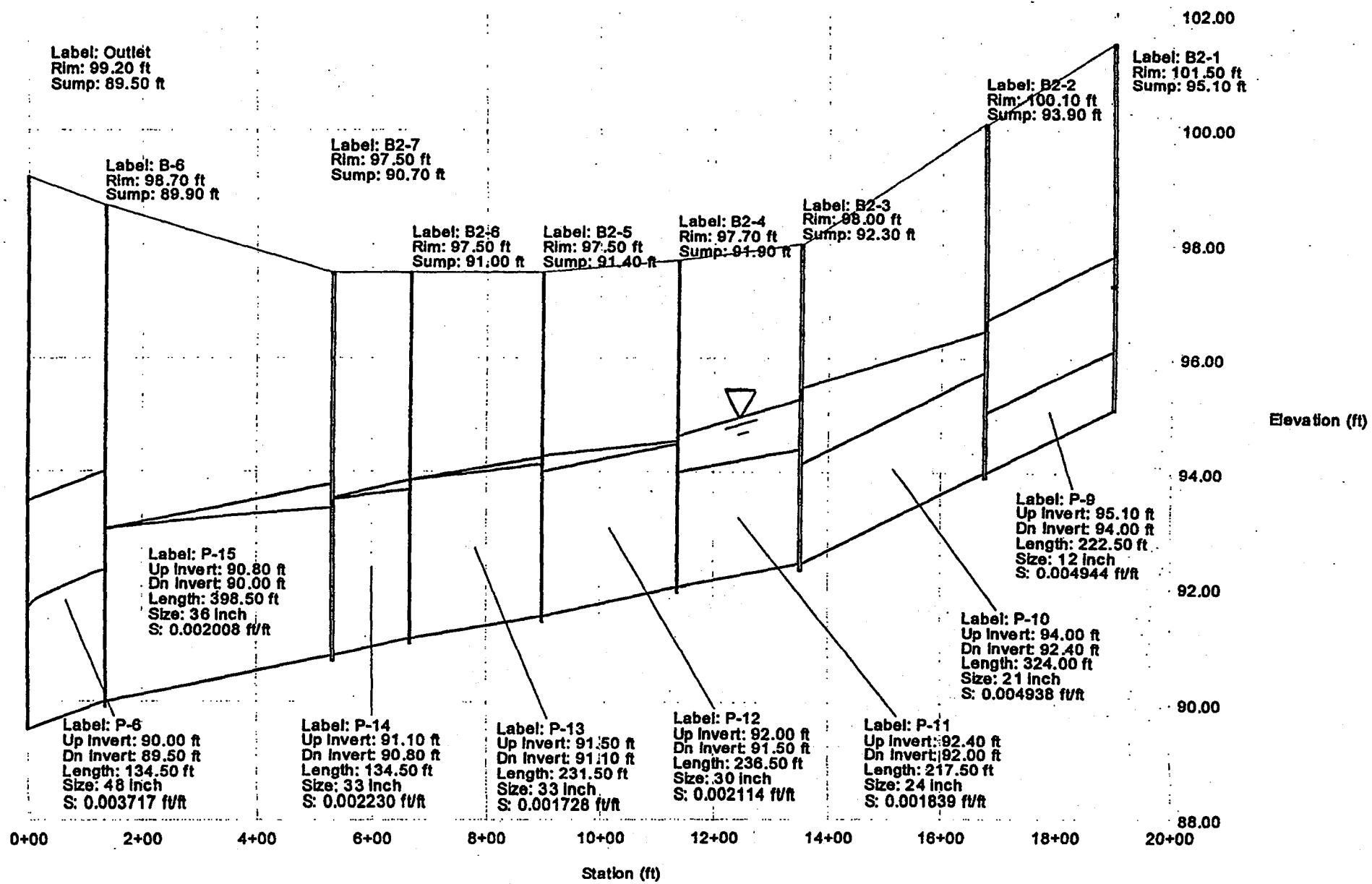
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Santina & Thompson Inc

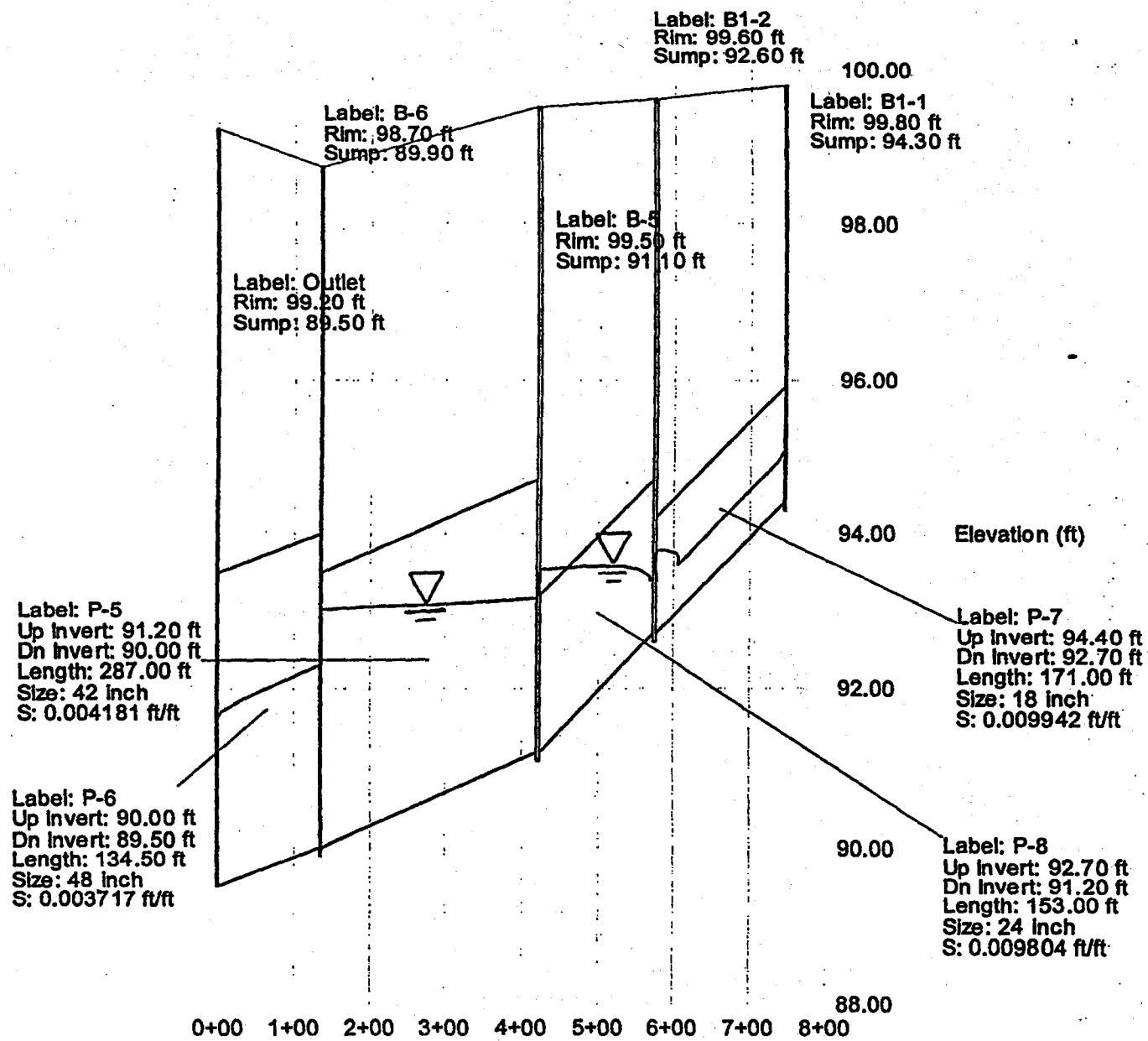
Project Engineer: SANT HOMPSON
Stop AD v3.0 [319b]

Profile

Scenario: Base



Profile
Scenario: Base



Pipe Information Table

Area C

5 Year Storm

Label	Up-stream Node	Section Size	Mannings n	Length (ft)	Con-structed Slope (ft/ft)	Upstream Invert Elevation (ft)	Down-stream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Down-stream Ground Elevation (ft)	Hydraulic Grade In (feet)	Hydraulic Grade Out (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Up-stream Cover (ft)	Down-stream Cover (ft)	Upstream Freeboard (feet)
P-1	C-1	24 inch	0.014	311.5	0.003852	96.6	95.4	104.6	103.2	97.31	96.71	3.55	2.84	6	5.8	7.3
P-2	C-2	24 inch	0.014	343.5	0.004076	95.4	94	103.2	101.5	96.42	95.59	6.97	3.73	5.8	5.5	6.8
P-3	C-3	27 inch	0.014	339.5	0.004124	94	92.6	101.5	99	95.3	94.9	10.36	3.23	5.25	4.15	6.2
P-4	C-4	30 inch	0.014	176	0.003977	92.6	91.9	99	98.8	94.69	94.44	16.14	3.43	3.9	4.4	4.3
P-5	C-5	36 inch	0.014	306.5	0.003915	91.9	90.7	98.8	98.5	94.27	94.02	19.65	2.91	3.9	4.8	4.5
P-6	C-6	42 inch	0.014	512.5	0.000976	90.7	90.2	98.5	97.5	93.86	93.4	29.75	3.24	4.3	3.8	4.6
P-7	C-7	48 inch	0.014	221.5	0.000903	90.2	90	97.5	98.7	93.26	93.13	31.24	2.99	3.3	4.7	4.2
P-8	C-8	48 inch	0.014	228.5	0.000875	90	89.8	98.7	98.5	92.97	92.81	32.59	3.24	4.7	4.7	5.7
P-9	C-9	48 inch	0.014	203	0.000985	89.8	89.6	98.5	98.3	92.6	92.41	34.39	3.66	4.7	4.7	5.9
P-10	C-10	54 inch	0.014	64	0.001562	89.6	89.5	98.3	98.8	91.9	91.47	46.64	6.05	4.2	4.8	6.4
P-11	C1-1	18 inch	0.014	282	0.002128	93.2	92.6	98.4	99	95.62	94.9	4.93	2.79	3.7	4.9	2.8
P-12	C2-1	18 inch	0.014	280.5	0.002139	92.5	91.9	98.6	98.8	94.65	94.44	2.69	1.52	4.6	5.4	3.9
P-13	C3-3	24 inch	0.014	335.5	0.002981	91.7	90.7	98.6	98.5	94.41	94.02	7.14	2.27	4.9	5.8	4.2
P-14	C3-2	21 inch	0.014	177	0.002825	92.2	91.7	98.7	98.6	94.94	94.49	7.42	3.08	4.75	5.15	3.8
P-15	C3-1	18 inch	0.014	203	0.002956	92.8	92.2	98.8	98.7	95.79	95.09	5.76	3.26	4.5	5	3.0
P-16	C4-1	18 inch	0.014	201	0.004975	91.2	90.2	97.6	97.5	93.49	93.4	2.01	1.14	4.9	5.8	4.1
P-17	C5-1	18 inch	0.014	310	0.005161	91.8	90.2	98.4	97.5	93.67	93.4	2.84	1.61	5.1	5.8	4.7
P-18	C6-1	18 inch	0.014	221	0.00181	91.9	91.5	97.7	97.7	95.07	94.67	4.17	2.36	4.3	4.7	2.6
P-19	C6-2	21 inch	0.014	228.5	0.002188	91.5	91	97.7	97.7	94.55	94.08	6.69	2.78	4.45	4.95	3.2
P-20	C6-3	24 inch	0.014	240	0.002083	91	90.5	97.7	97.7	93.94	93.45	9.47	3.01	4.7	5.2	3.8
P-21	C6-4	24 inch	0.014	99.5	0.00201	90.5	90.3	97.7	97.7	93.2	92.85	12.52	3.98	5.2	5.4	4.5
P-22	C6-5	36 inch	0.014	313.5	0.001914	90.3	89.7	97.7	98.2	92.76	92.61	14.85	2.24	4.4	5.5	4.9
P-23	C7-1	18 inch	0.014	184.5	0.00271	92.5	92	98.9	99.2	96.51	95.96	5.32	3.01	4.9	5.7	2.4
P-24	C7-2	21 inch	0.014	232.5	0.003011	92	91.3	99.2	99.3	95.8	95.14	7.8	3.24	5.45	6.25	3.4
P-25	C7-3	21 inch	0.014	170	0.002941	91.3	90.8	99.3	99.5	94.83	93.92	10.76	4.47	6.25	6.95	4.5
P-26	C7-4	24 inch	0.014	351.5	0.003129	90.8	89.7	99.5	98.2	93.71	92.61	11.72	3.73	6.7	6.5	5.8
P-27	c6-6	42 inch	0.014	58	0.001724	89.7	89.6	98.2	98.3	92.45	92.41	26.34	3.22	5	5.2	5.8

February 11, 2000

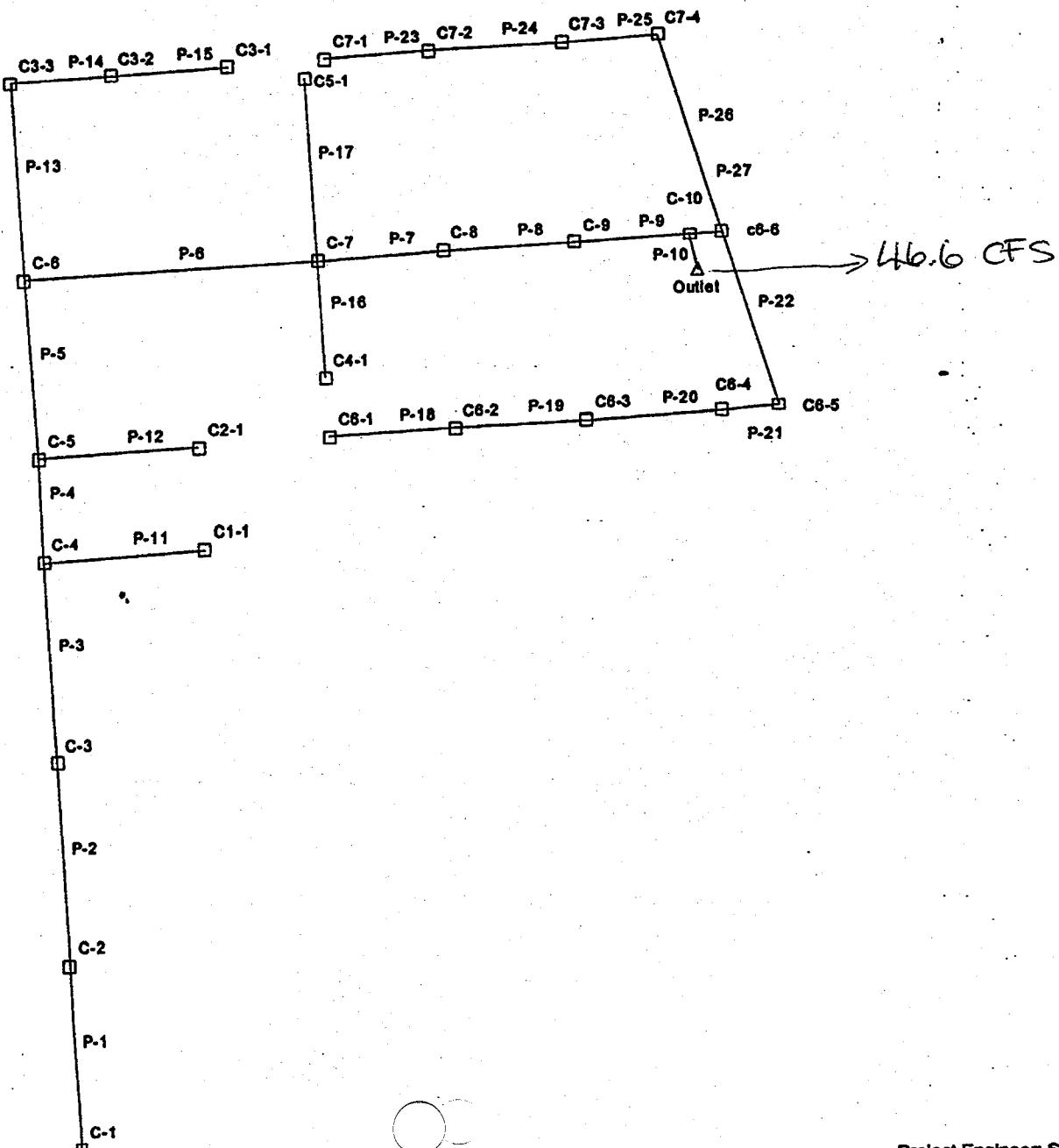
Node Information Table

Area C 5 Year Storm

Node	Inlet Area (acres)	Inlet C Coefficient	Inlet CA (acres)	System Contributing Area (acres)	External Tc (min)	System Flow Time (min)	System Intensity (in/hr)	System Rational Flow (cfs)	Additional Flow (cfs)	Total System Flow (cfs)	Local Intensity (in/hr)	Local Rational Flow (cfs)	HGL In (ft)	HGL Out (ft)	Rim Elevation (ft)
C-1	0.58	0.85	0.49	0.49	0	5	3.13	1.55	2	3.55	3.13	1.55	97.51	97.31	104.6
C-2	1.51	0.85	1.28	1.78	0	6.83	2.77	4.97	0	6.97	4.15	5.36	96.71	96.42	103.2
C-3	1.74	0.85	1.48	3.26	0	8.36	2.55	8.36	0	10.36	4.15	6.18	95.59	95.3	101.5
C-4	1.49	0.85	1.27	6.09	0	10.11	2.31	14.14	0	16.14	4.15	5.29	94.9	94.69	99
C-5	0.95	0.85	0.81	7.43	0	10.97	2.22	16.65	0	19.65	4.15	3.37	94.44	94.27	98.8
C-6	3.4	0.85	2.89	12.9	0	12.73	2.06	26.75	0	29.75	4.15	12.08	94.02	93.86	98.5
C-7	1.15	0.85	0.98	15.42	0	15.36	1.82	28.24	0	31.24	4.15	4.09	93.4	93.26	97.5
C-8	1.71	0.85	1.45	16.87	0	16.6	1.74	29.59	0	32.59	4.15	6.07	93.13	92.97	98.7
C-9	2.14	0.85	1.82	18.69	0	17.77	1.67	31.39	0	34.39	4.15	7.6	92.81	92.6	98.5
C-10	1.25	0.85	1.06	28.78	0	18.7	1.61	46.64	-10	46.64	4.15	4.44	92.41	91.9	98.3
C1-1	1.84	0.85	1.56	1.56	0	5	3.13	4.93	0	4.93	3.13	4.93	95.74	95.62	98.4
C2-1	0.63	0.85	0.54	0.54	0	5	3.13	1.69	1	2.69	3.13	1.69	94.69	94.65	98.6
C3-1	2.15	0.85	1.83	1.83	0	5	3.13	5.76	0	5.76	3.13	5.76	95.96	95.79	98.8
C3-2	0.82	0.85	0.7	2.52	0	6.04	2.92	7.42	0	7.42	4.15	2.91	95.09	94.94	98.7
C3-3	0.07	0.85	0.06	2.58	0	6.99	2.74	7.14	0	7.14	4.15	0.25	94.49	94.41	98.6
C4-1	0.75	0.85	0.64	0.64	0	5	3.13	2.01	0	2.01	3.13	2.01	93.51	93.49	97.6
C5-1	1.06	0.85	0.9	0.9	0	5	3.13	2.84	0	2.84	3.13	2.84	93.71	93.67	98.4
C6-1	0.81	0.85	0.69	0.69	0	5	3.13	2.17	2	4.17	3.13	2.17	95.16	95.07	97.7
C6-2	1.13	0.85	0.96	1.65	0	6.56	2.82	4.69	0	6.69	4.15	4.01	94.67	94.55	97.7
C6-3	1.4	0.85	1.19	2.84	0	7.93	2.61	7.47	0	9.47	4.15	4.97	94.08	93.94	97.7
C6-4	1.73	0.85	1.47	4.31	0	9.26	2.42	10.52	0	12.52	4.15	6.15	93.45	93.2	97.7
C6-5	1.28	0.85	1.09	5.4	0	9.67	2.36	12.85	0	14.85	4.15	4.55	92.85	92.76	97.7
c6-6	1.28	0.85	1.09	9.03	0	12	2.13	19.34	0	26.34	4.15	4.55	92.61	92.45	98.2
C7-1	0.12	0.85	0.1	0.1	0	5	3.13	0.32	5	5.32	3.13	0.32	96.65	96.51	98.9
C7-2	1	0.85	0.85	0.95	0	6.02	2.92	2.8	0	7.8	4.15	3.55	95.96	95.8	99.2
C7-3	1.36	0.85	1.16	2.11	0	7.22	2.71	5.76	0	10.76	4.15	4.83	95.14	94.83	99.3
C7-4	0.51	0.85	0.43	2.54	0	7.85	2.62	6.72	0	11.72	4.15	1.81	93.92	93.71	99.5
Outlet				28.78		18.87	1.6	46.32		46.32			91.47	91.47	98.8

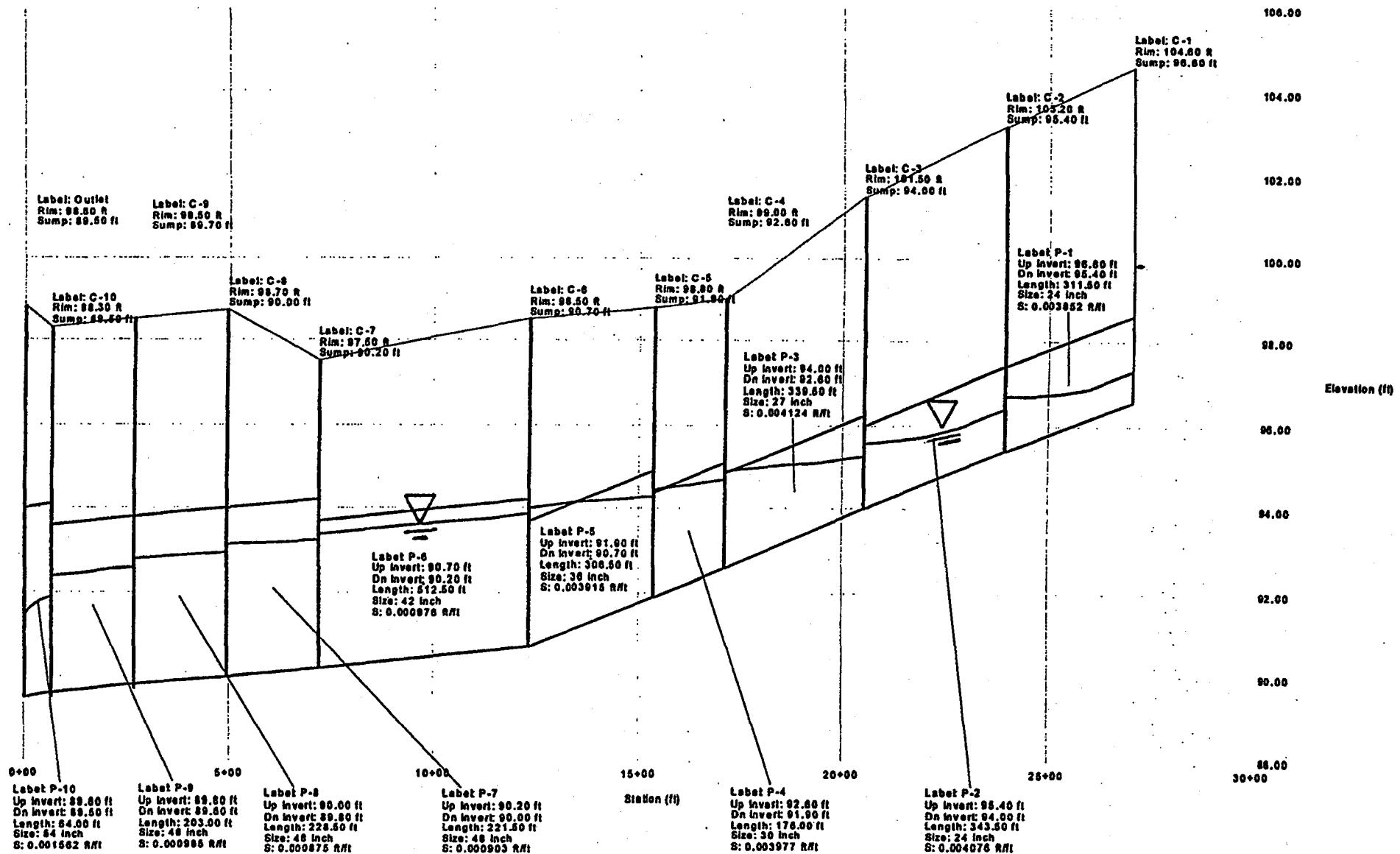
February 11, 2000

Scenario: Base

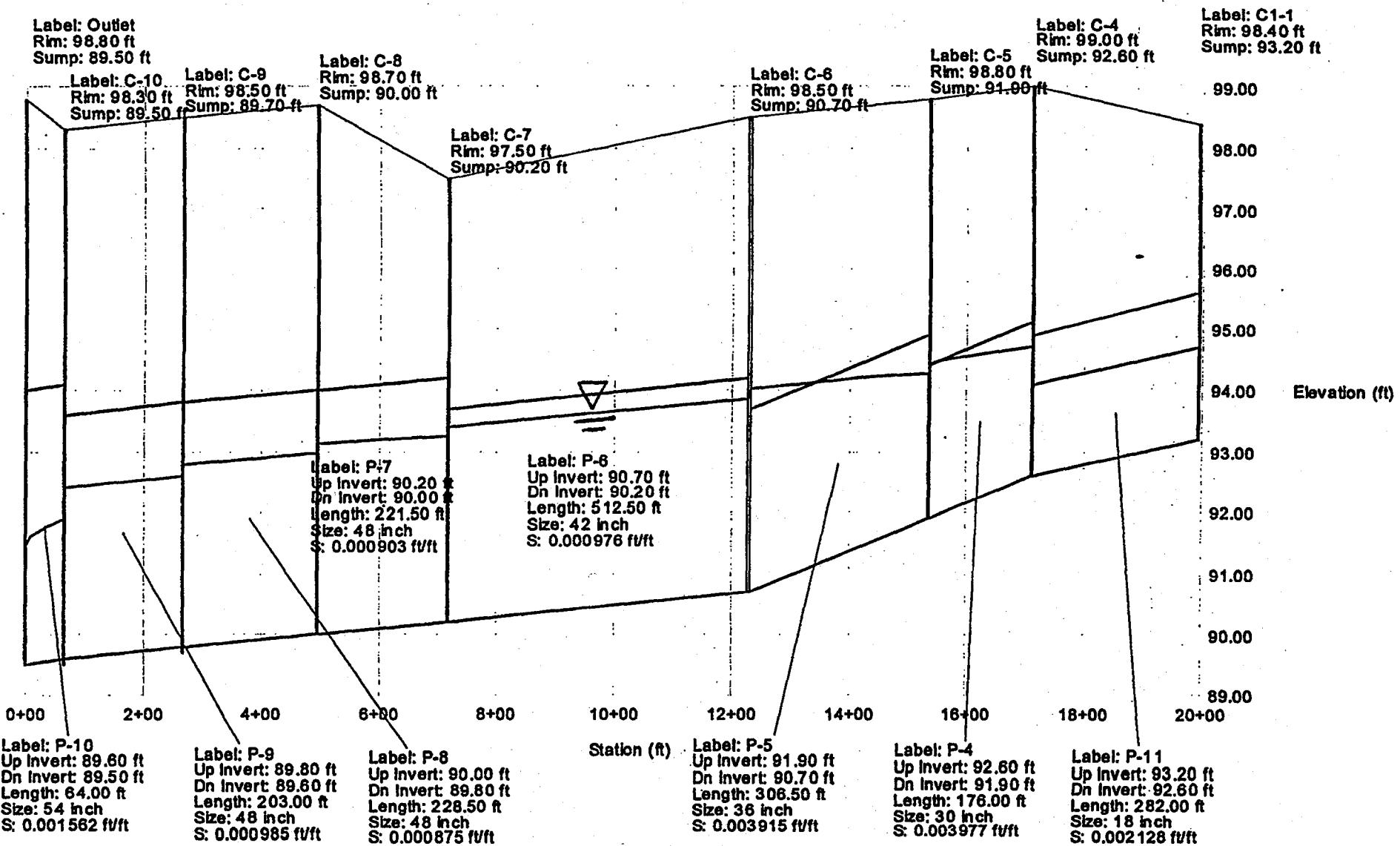


Profile

Scenario: Base

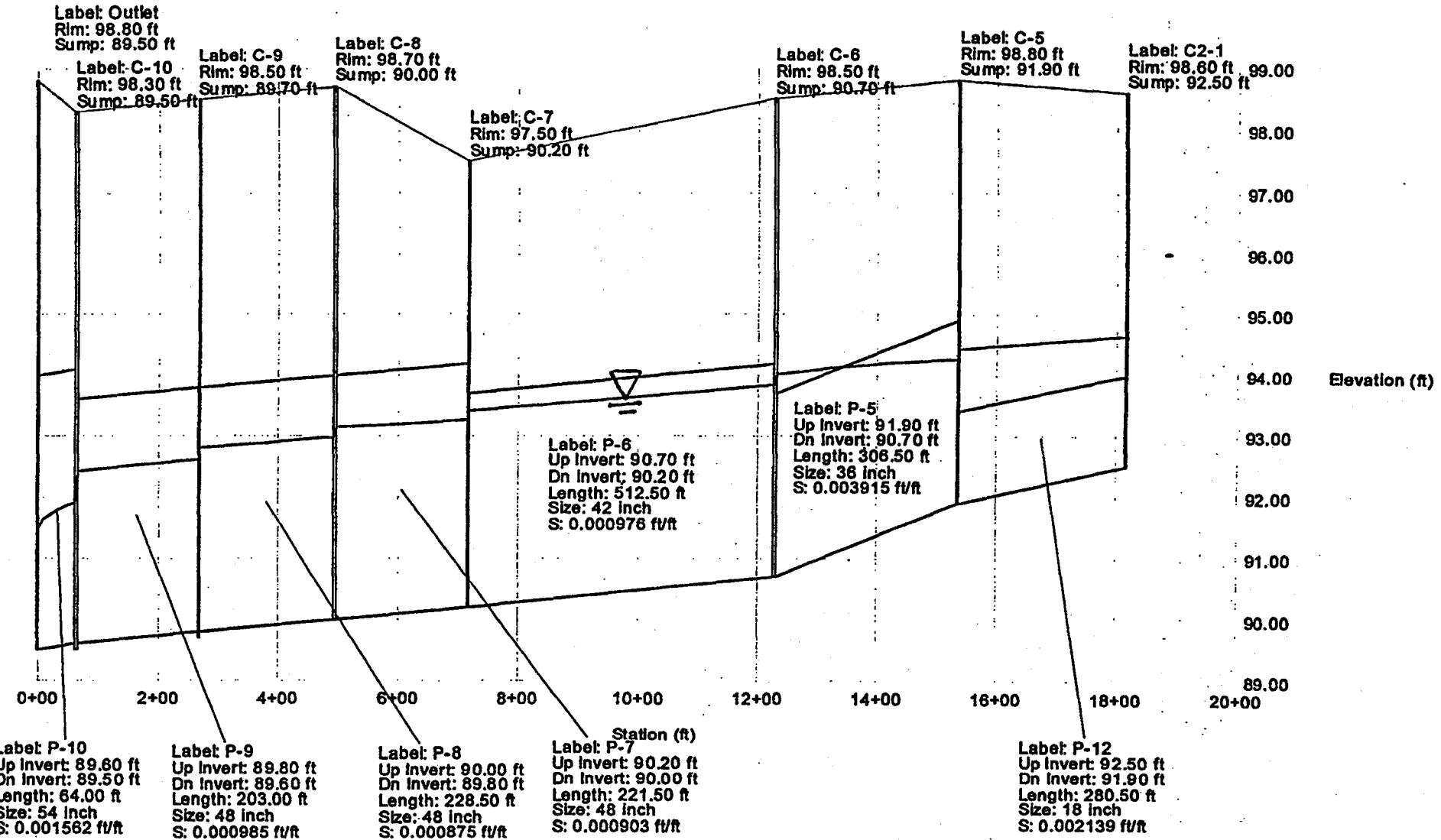


**Profile
Scenario: Base**

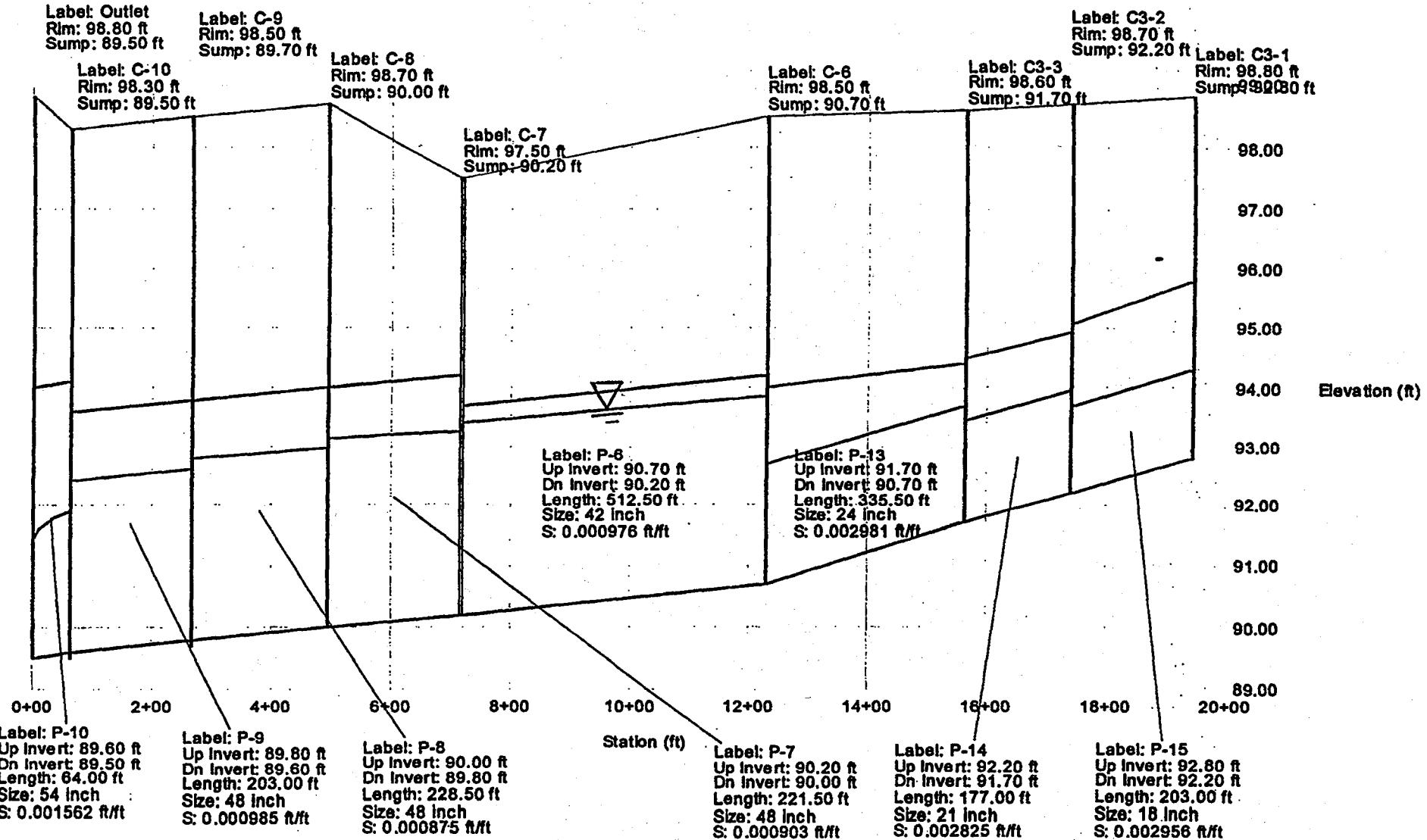


Profile

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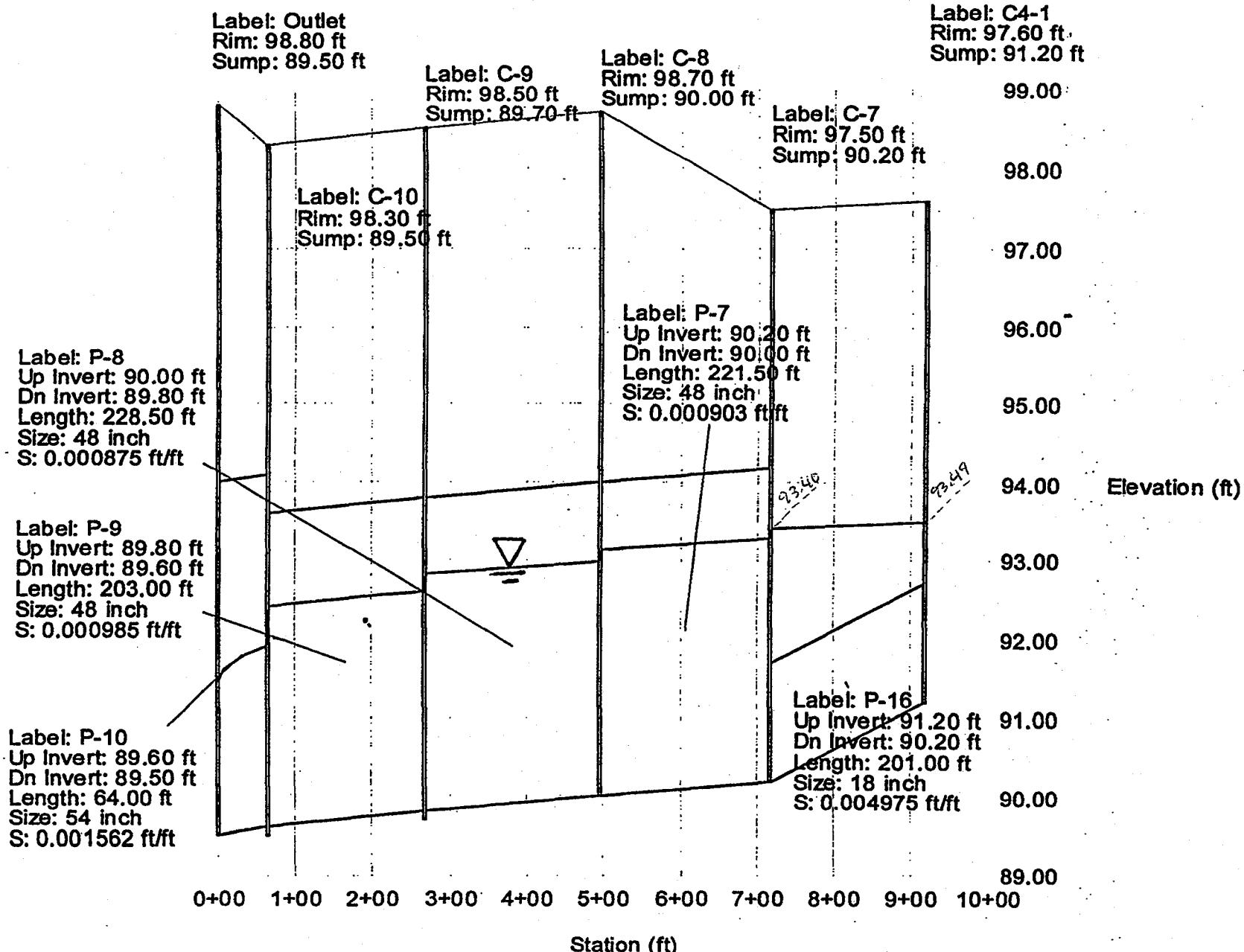


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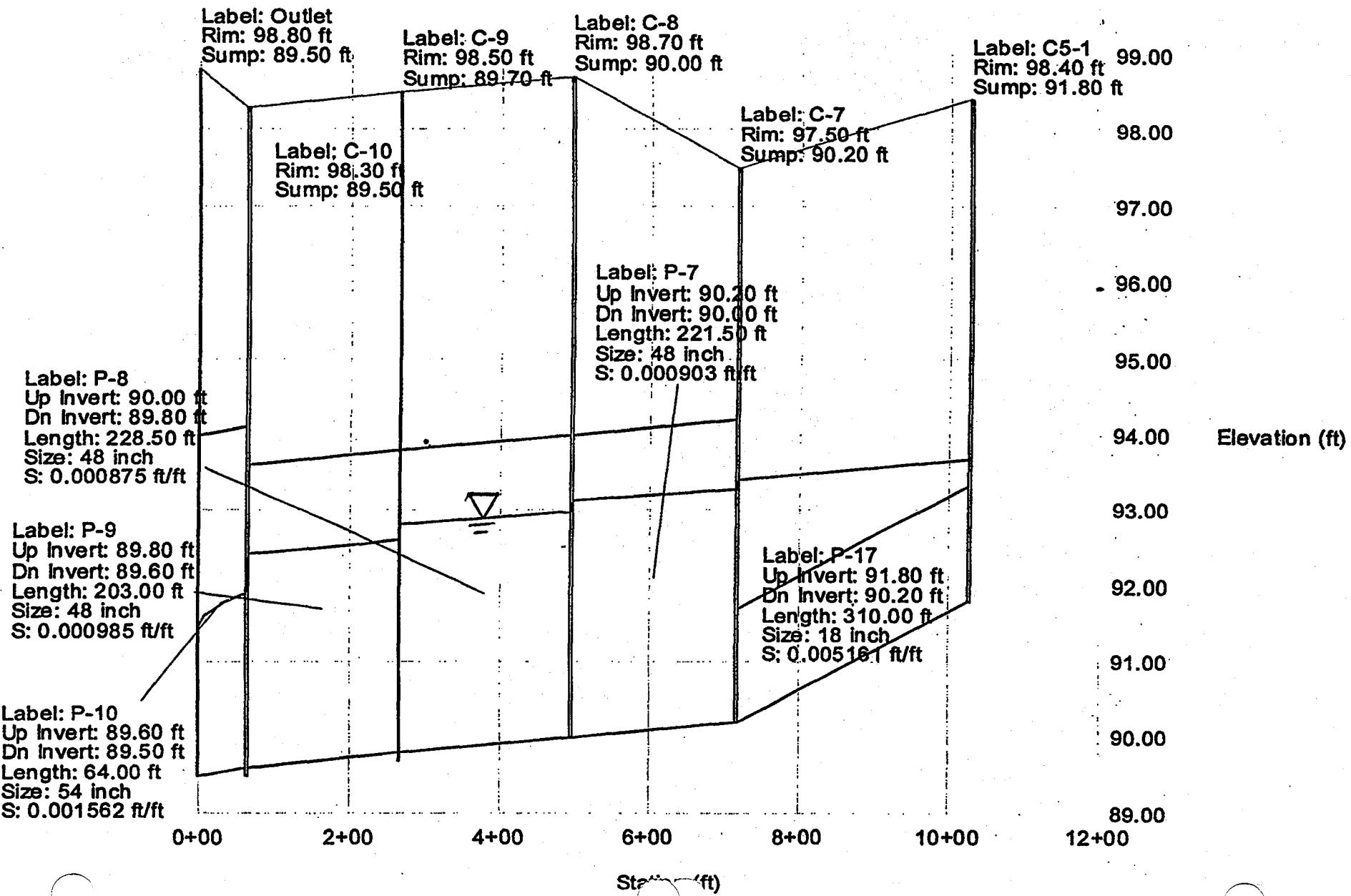


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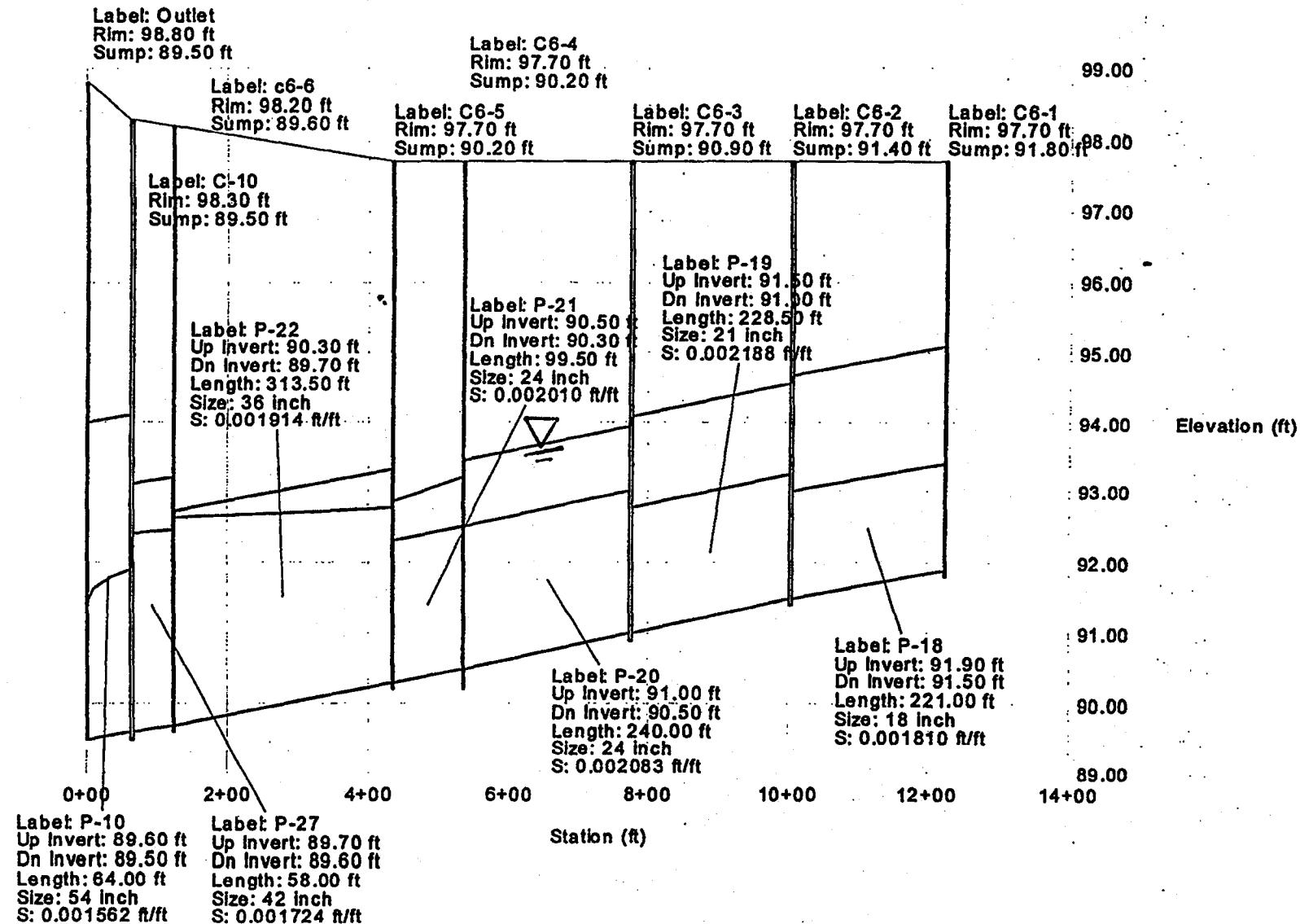


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Scenario: Base

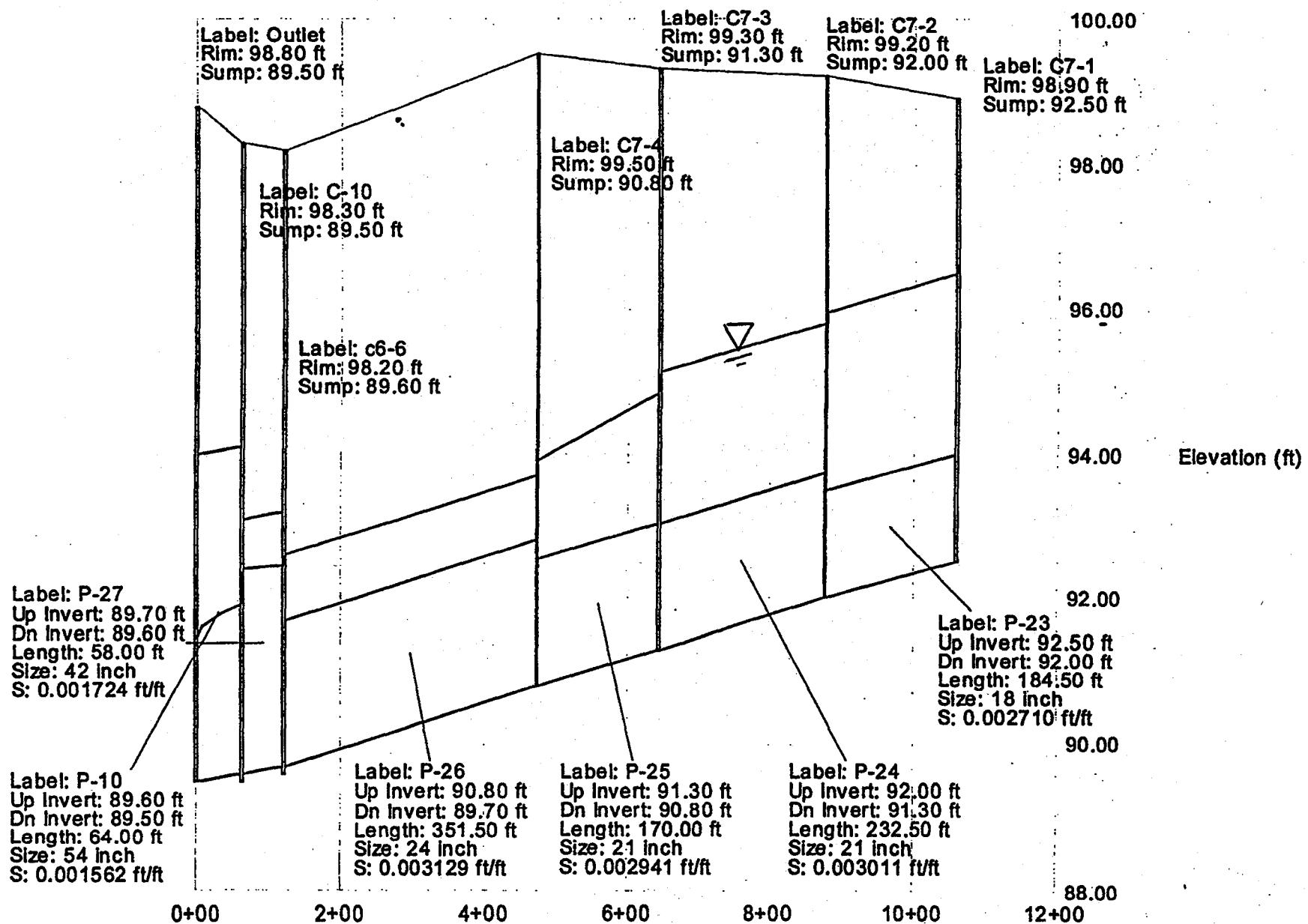


Profile

Scenario: Base



Profile
Scenario: Base



Pipe Information Table

Area D

5 Year Storm

Label	Up-stream Node	Section Size	Mannings n	Length (ft)	Con-structed Slope (ft/ft)	Upstream Invert Elevation (ft)	Down-stream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Down-stream Ground Elevation (ft)	Hydraulic Grade In (feet)	Hydraulic Grade Out (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Up-stream Cover (ft)	Down-stream Cover (ft)	Upstream Freeboard (feet)
P-1	D-1	24 inch	0.014	253.5	0.001578	92.6	92.2	97.5	97.6	96.26	96.15	4.42	1.41	2.9	3.4	1.2
P-2	D-2	27 inch	0.014	266	0.001504	92.2	91.8	97.6	97.6	96.11	95.97	6.57	1.65	3.15	3.55	1.5
P-3	D-3	30 inch	0.014	262	0.001527	91.8	91.4	97.6	98.4	95.86	95.56	12.98	2.64	3.3	4.5	1.7
P-5	D-4	33 inch	0.014	169	0.001183	91.4	91.2	98.4	99.1	95.47	95.34	13.88	2.34	4.25	5.15	2.9
P-6	D-5	36 inch	0.014	80.5	0.001242	91.2	91.1	99.1	99.1	95.19	95.1	21.51	3.04	4.9	5	3.9
P-7	D-6	36 inch	0.014	227.5	0.001758	91.1	90.7	99.1	99.2	94.95	94.66	21.95	3.11	5	5.5	4.1
P-8	D-7	36 inch	0.014	233.5	0.001285	90.7	90.4	99.2	99.2	94.45	94.05	25.84	3.66	5.5	5.8	4.8
P-9	D-8	48 inch	0.014	275	0.001455	90.4	90	99.2	99.4	93.78	93.47	47.21	4.13	4.8	5.4	5.4
P-10	D-9	48 inch	0.014	233.5	0.001713	90	89.6	99.4	99.5	93.1	92.73	50.95	4.86	5.4	5.9	6.3
P-11	D-10	54 inch	0.014	96.5	0.001036	89.6	89.5	99.5	100	92.24	91.64	54.33	6.14	5.4	6	7.3
P-12	D1-1	18 inch	0.014	253.5	0.001578	92.8	92.4	97.9	98.1	96.54	96.42	2.14	1.21	3.6	4.2	1.4
P-13	D1-2	21 inch	0.014	266	0.001504	92.4	92	98.1	98.4	96.32	95.86	6.14	2.55	3.95	4.65	1.8
P-14	D1-3	27 inch	0.014	203	0.001478	92	91.7	98.4	98.7	95.79	95.63	8.04	2.02	4.15	4.75	2.6
P-15	D1-4	30 inch	0.014	269	0.001487	91.7	91.3	98.7	99	95.58	95.44	8.8	1.79	4.5	5.2	3.1
P-16	D1-5	30 inch	0.014	91.5	0.001093	91.3	91.2	99	99.1	95.39	95.34	8.96	1.82	5.2	5.4	3.6
P-19	D4-1	30 inch	0.014	257	0.001556	91.2	90.8	98.8	99	94.34	94.19	9.23	1.88	5.1	5.7	4.5
P-20	D4-2	42 inch	0.014	298.5	0.00134	90.8	90.4	99	99.2	94.14	94.05	16.73	1.75	4.7	5.3	4.9

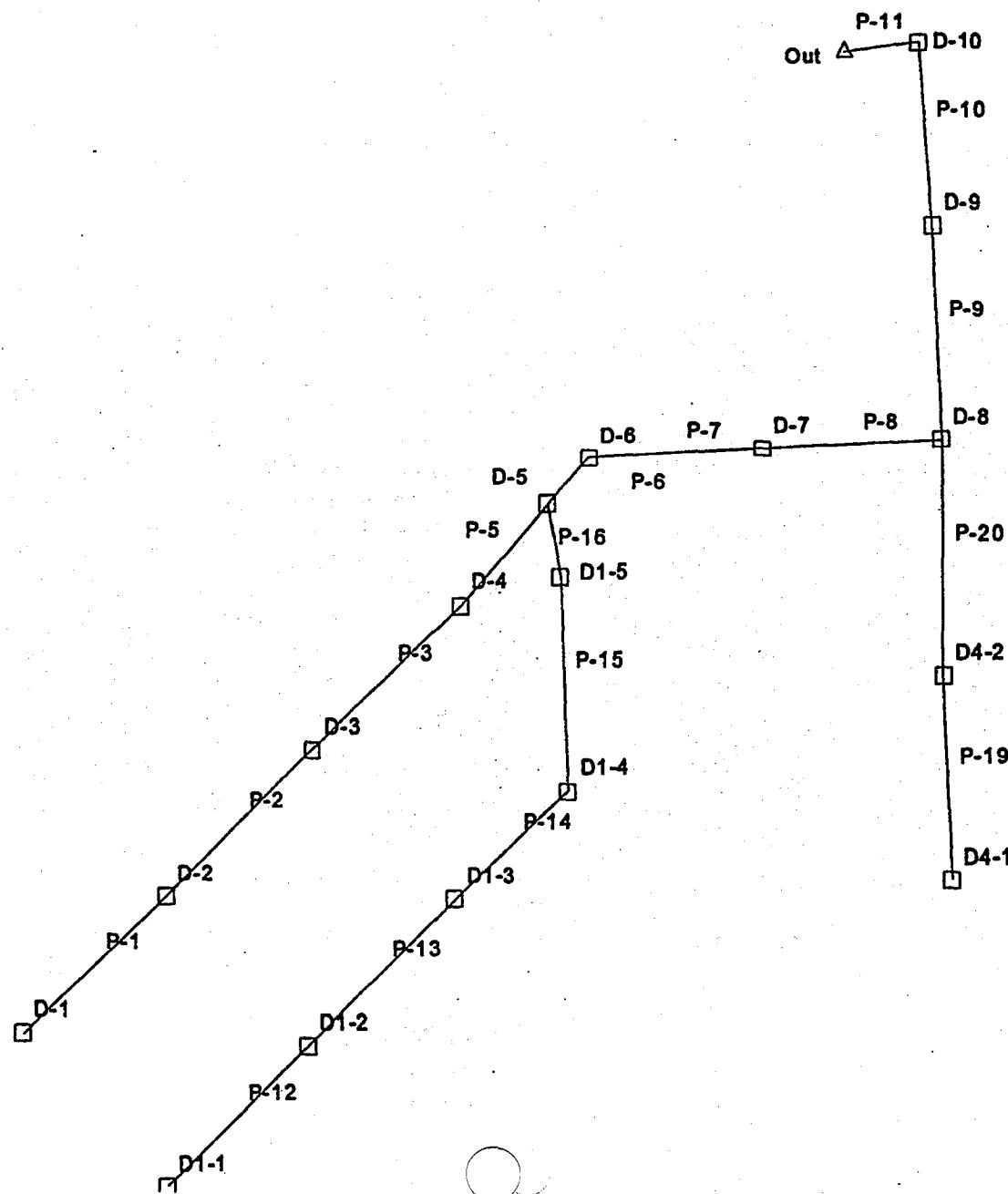
February 11, 2000

Node Information Table
Area D
5 Year Storm

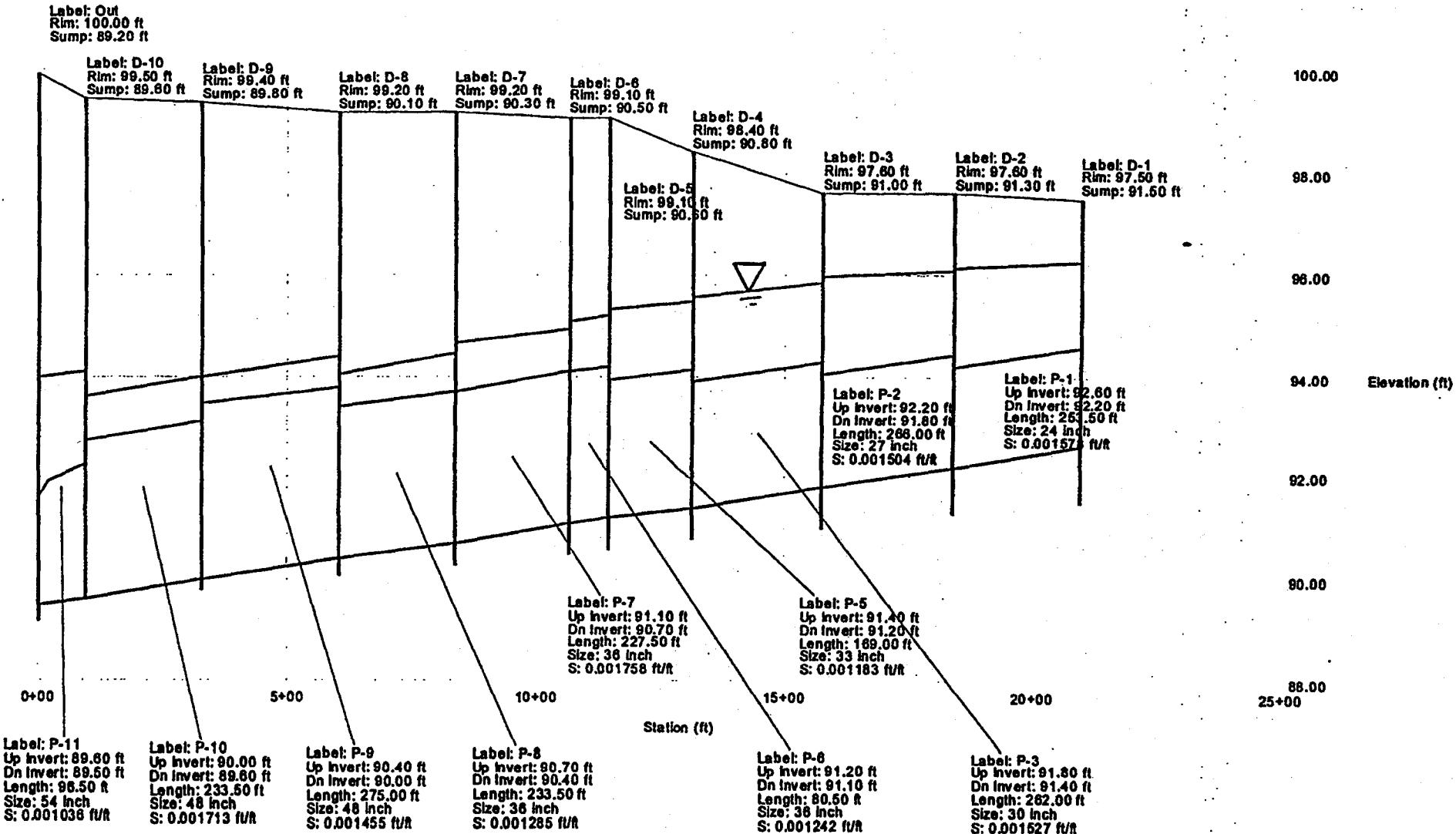
Node	Inlet Area (acres)	Inlet C Coefficient	Inlet CA (acres)	System Contributing Area (acres)	Ex-ternal Tc (min)	System Flow Time (min)	System In-tensity (in/hr)	System Rational Flow (cfs)	Ad-ditional Flow (cfs)	Total System Flow (cfs)	Local In-tensity (in/hr)	Local Rational Flow (cfs)	HGL In (ft)	HGL Out (ft)	Rim Elevation (ft)
D-1	1.65	0.85	1.4	1.4	0	5	3.13	4.42	0	4.42	3.13	4.42	96.3	96.26	97.5
D-2	1.3	0.85	1.1	2.51	0	8	2.6	6.57	0	6.57	4.15	4.62	96.15	96.11	97.6
D-3	3.78	0.85	3.21	5.72	0	10.69	2.25	12.98	0	12.98	4.15	13.43	95.97	95.86	97.6
D-4	1.01	0.85	0.86	6.58	0	12.34	2.09	13.88	0	13.88	4.15	3.59	95.56	95.47	98.4
D-5	0.5	0.85	0.43	11.69	0	15.23	1.83	21.51	0	21.51	4.15	1.78	95.34	95.19	99.1
D-6	0.5	0.85	0.43	12.11	0	15.67	1.8	21.95	0	21.95	4.15	1.78	95.1	94.95	99.1
D-7	3.27	0.85	2.78	14.89	0	16.89	1.72	25.84	0	25.84	4.15	11.62	94.66	94.45	99.2
D-8	6.49	0.85	5.52	28.31	0	17.96	1.65	47.21	0	47.21	4.15	23.05	94.05	93.78	99.2
D-9	4.22	0.85	3.59	31.9	0	19.07	1.58	50.95	0	50.95	4.15	14.99	93.47	93.1	99.4
D-10	3.8	0.85	3.23	35.13	0	19.87	1.53	54.33	0	54.33	4.15	13.5	92.73	92.24	99.5
D1-1	0.8	0.85	0.68	0.68	0	5	3.13	2.14	0	2.14	3.13	2.14	96.57	96.54	97.9
D1-2	2.03	0.85	1.73	2.41	0	8.48	2.53	6.14	0	6.14	4.15	7.21	96.42	96.32	98.1
D1-3	1.26	0.85	1.07	3.48	0	10.22	2.29	8.04	0	8.04	4.15	4.48	95.86	95.79	98.4
D1-4	0.72	0.85	0.61	4.09	0	11.89	2.14	8.8	0	8.8	4.15	2.56	95.63	95.58	98.7
D1-5	0.7	0.85	0.6	4.68	0	14.4	1.9	8.96	0	8.96	4.15	2.49	95.44	95.39	99
D4-1	4.65	0.85	3.95	3.95	0	10	2.32	9.23	0	9.23	2.32	9.23	94.39	94.34	98.8
D4-2	4.65	0.85	3.95	7.91	0	12.28	2.1	16.73	0	16.73	4.15	16.52	94.19	94.14	99
Out				35.13		20.13	1.52	53.83		53.83			91.64	91.64	100

February 11, 2000

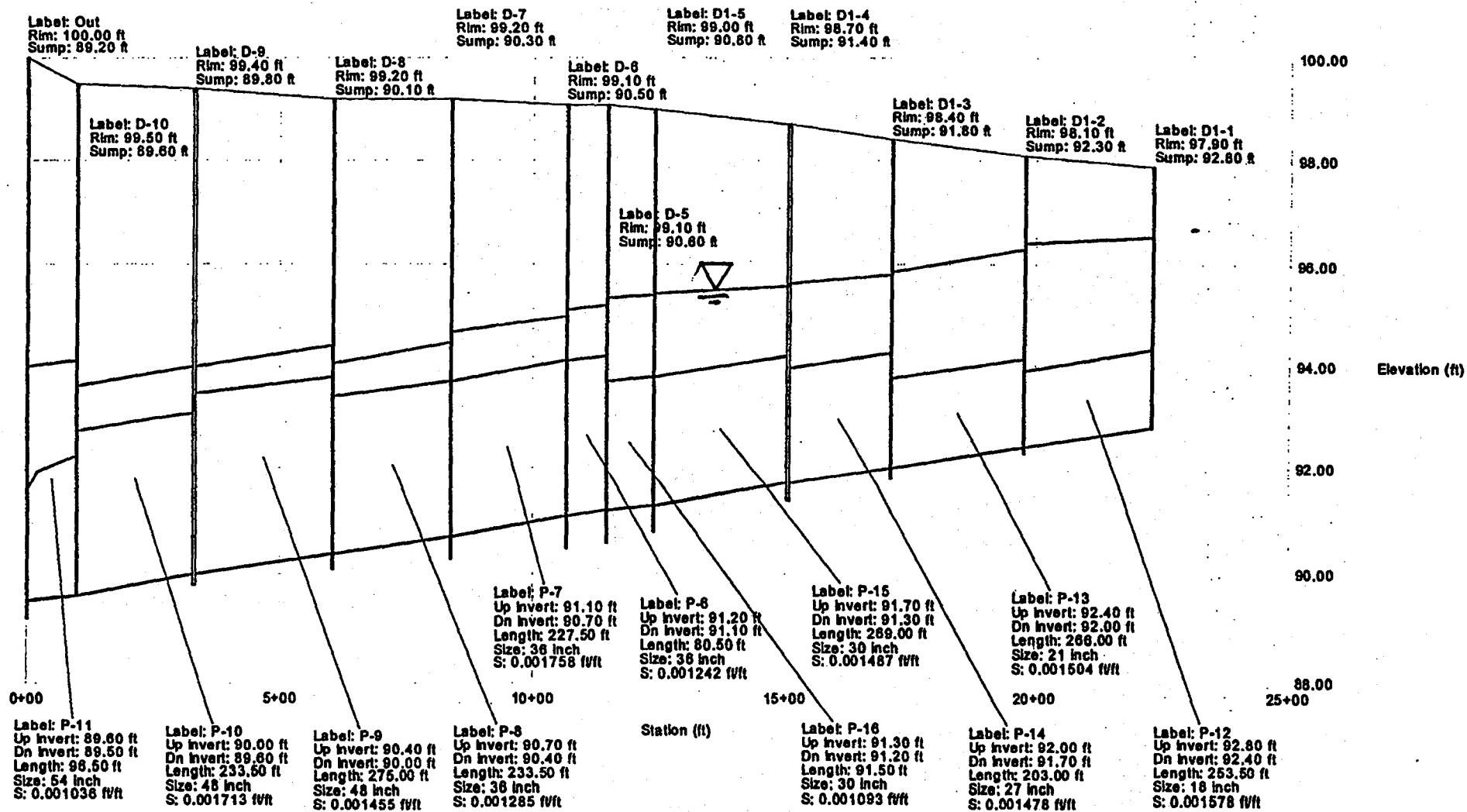
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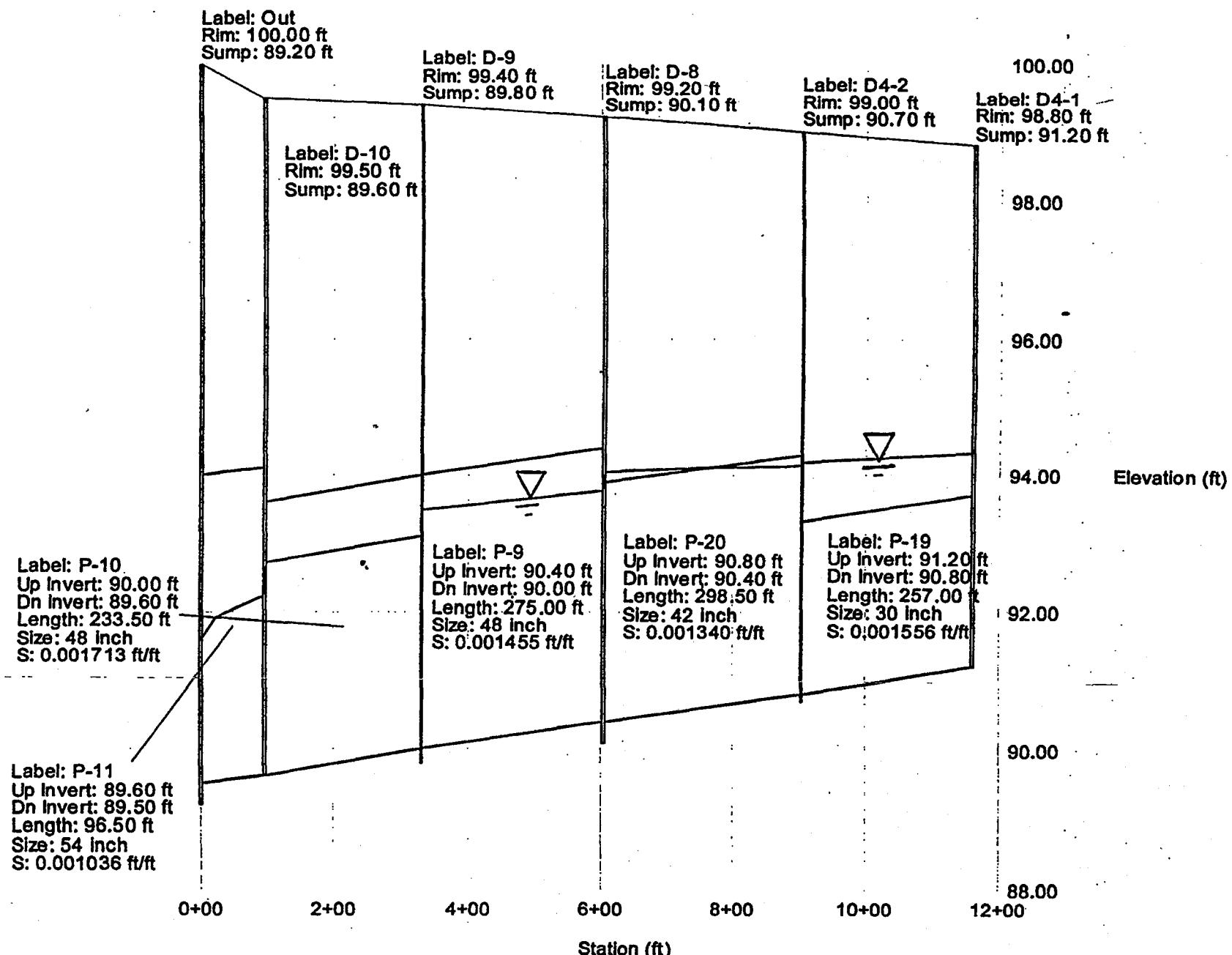
Profile
Scenario: Base



Profile
Scenario: Base



Profile
Scenario: Base



Pipe Information Table
Area E
5 Year Storm

Label	Up-stream Node	Section Size	Mannings n	Length (ft)	Con-structed Slope (ft/ft)	Upstream Invert Elevation (ft)	Down-stream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Down-stream Ground Elevation (ft)	Hydraulic Grade In (feet)	Hydraulic Grade Out (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Up-stream Cover (ft)	Down-stream Cover (ft)	Upstream Freeboard (feet)
P-1	E-1	8 inch	0.014	466.5	0.002144	93.1	92.1	98.5	98.2	97.12	96.6	0.38	1.08	4.73	5.43	1.4
P-2	E-2	24 inch	0.014	171	0.001754	92.1	91.8	98.2	98	96.54	96.39	6.15	1.96	4.1	4.2	1.7
P-3	E-3	27 inch	0.014	362.5	0.001931	91.8	91.1	98	98	96.29	95.83	10.29	2.59	3.95	4.65	1.7
P-4	E-4	30 inch	0.014	71.5	0.002797	91.1	90.9	98	98	95.77	95.72	9.61	1.96	4.4	4.6	2.2
P-5	E-5	36 inch	0.014	50	0.002	90.9	90.8	98	98	95.64	95.61	16.11	2.28	4.1	4.2	2.4
P-6	E-6	48 inch	0.014	317.5	0.00189	90.8	90.2	98	97.8	95.35	94.89	50.84	4.05	3.2	3.6	2.7
P-7	E-7	48 inch	0.014	126.5	0.002372	90.2	89.9	97.8	97.7	94.63	94.45	50.93	4.05	3.6	3.8	3.2
P-8	E-8	48 inch	0.014	114	0.001754	89.9	89.7	97.7	97.6	94.09	93.85	60.75	4.84	3.8	3.9	3.6
P-9	E-9	54 inch	0.014	101.5	0.00197	89.7	89.5	97.6	98.1	93.06	92.3	90.86	7.64	3.4	4.1	4.5
P-10	E2-1	10 inch	0.014	239.5	0.004175	92.8	91.8	98.3	98.6	96.1	95.92	0.56	1.03	4.67	5.97	2.2
P-11	E1-1	10 inch	0.014	385.5	0.002075	92.6	91.8	98.8	98.6	96.99	95.92	1.07	1.97	5.37	5.97	1.8
P-12	E1-2	27 inch	0.014	447	0.002013	91.8	90.9	98.6	98	95.89	95.72	5.61	1.41	4.55	4.85	2.7
P-13	E3-1	12 inch	0.014	354.5	0.001975	92.7	92	98.9	98.5	97.77	97.54	0.94	1.1	5.16	5.46	1.1
P-14	E3-2	36 inch	0.014	245.5	0.002037	92	91.5	98.5	98.3	97.23	96.59	31.72	4.49	3.5	3.8	1.3
P-15	E3-3	42 inch	0.014	233.5	0.002141	91.5	91	98.3	98	96.41	96.12	32.57	3.39	3.3	3.5	1.9
P-16	E3-4	42 inch	0.014	109	0.001835	91	90.8	98	98	95.83	95.61	42.08	4.37	3.5	3.7	2.2
P-17	E4-1	24 inch	0.014	165	0.002424	91.8	91.4	97.6	97.7	96.51	96.41	4.99	1.59	3.8	4.3	1.1
P-18	E4-2	24 inch	0.014	178	0.002809	91.4	90.9	97.7	97.8	96.31	96.05	8.07	2.57	4.3	4.9	1.4
P-19	E4-3	24 inch	0.014	301	0.002326	90.9	90.2	97.8	97.7	95.9	95.24	9.79	3.12	4.9	5.5	1.9
P-20	E4-4	24 inch	0.014	104.5	0.002871	90.2	89.9	97.7	97.7	94.93	94.45	14.17	4.51	5.5	5.8	2.8
P-21	E5-1	24 inch	0.014	200.5	0.00399	95.4	94.6	101.2	100.9	99.79	99.6	6.55	2.09	3.8	4.3	1.4
P-22	E5-2	24 inch	0.014	240	0.00375	94.6	93.7	100.9	100.3	99.37	98.57	12.13	3.86	4.3	4.6	1.5
P-23	E5-3	30 inch	0.014	234.5	0.004264	93.7	92.7	100.3	99.6	98.36	97.85	17.79	3.62	4.1	4.4	1.9
P-24	E5-4	30 inch	0.014	206.5	0.003874	92.7	91.9	99.6	98.7	97.56	96.92	21.21	4.32	4.4	4.3	2.0
P-25	E5-5	33 inch	0.014	212	0.003774	91.9	91.1	98.7	98.3	96.62	96.01	26.29	4.43	4.05	4.45	2.1
P-26	E5-6	36 inch	0.014	138.5	0.004332	91.1	90.5	98.3	98	95.69	95.32	31.94	4.52	4.2	4.5	2.6
P-27	E5-7	36 inch	0.014	118.5	0.004219	90.5	90	98	97.7	94.99	94.66	32.73	4.63	4.5	4.7	3.0
P-28	E5-8	36 inch	0.014	81.5	0.003681	90	89.7	97.7	97.6	94.18	93.85	39.3	5.56	4.7	4.9	3.5

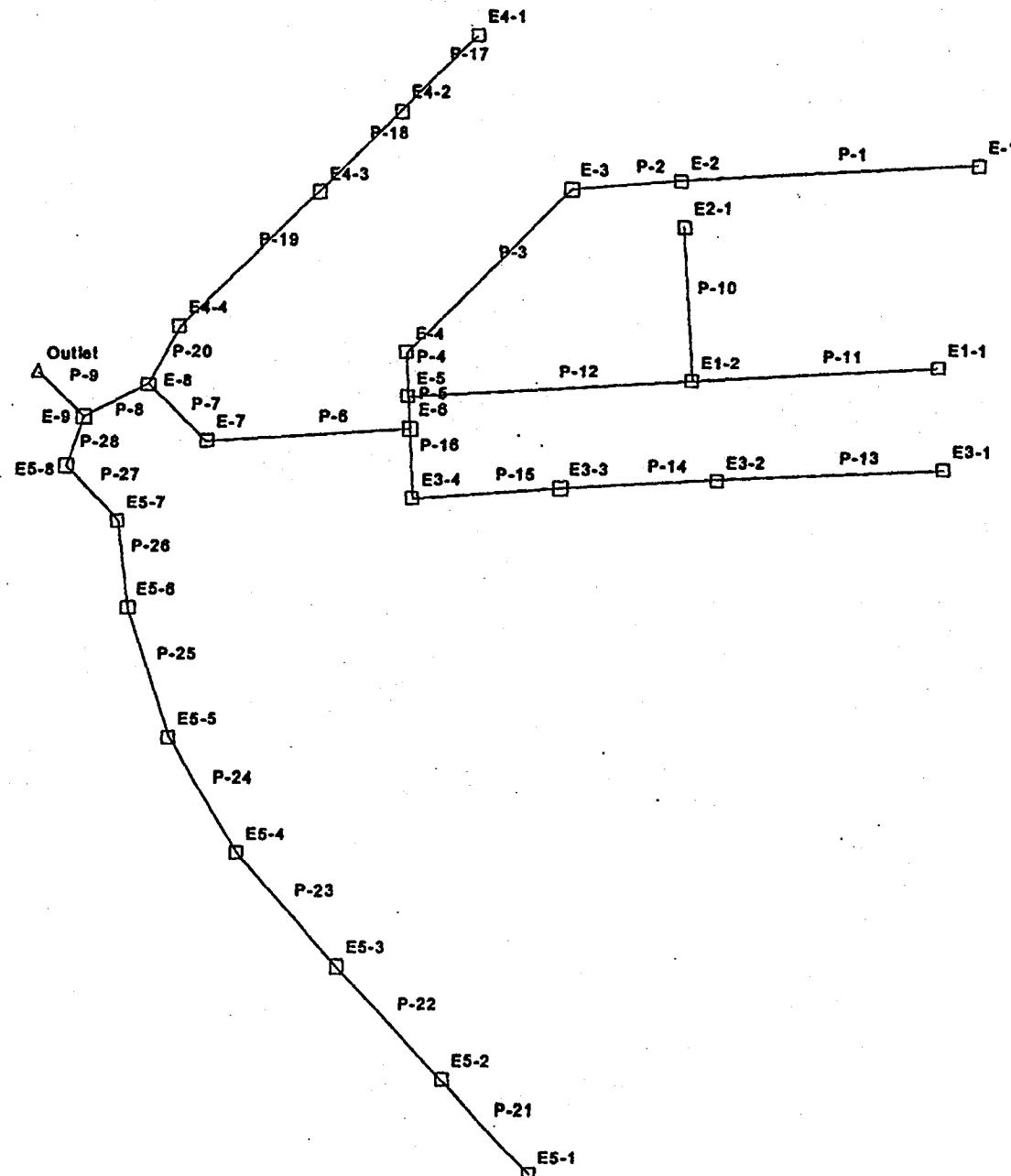
February 11, 2000

Node Information Table
Area E
5 Year Storm

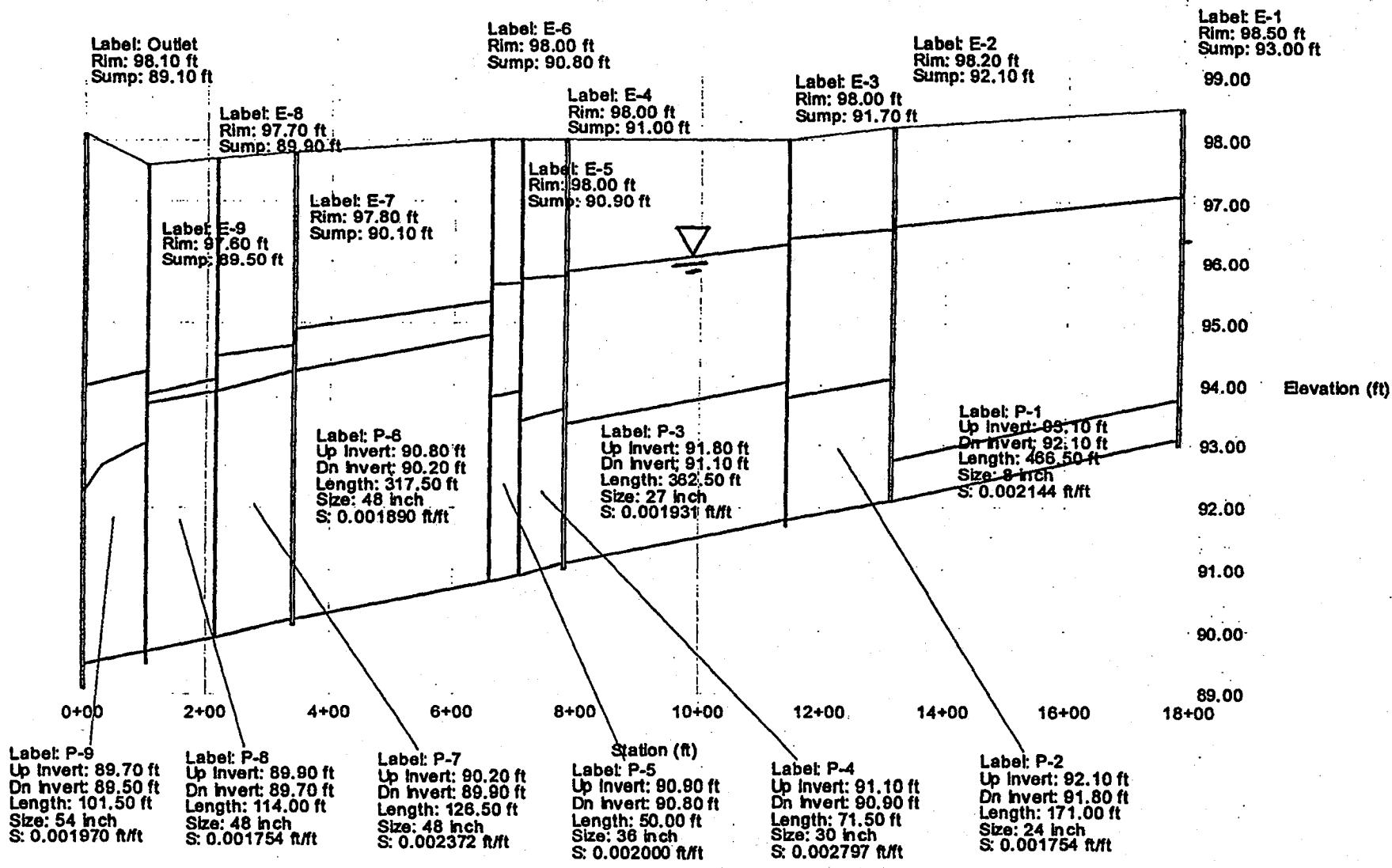
Node	Inlet Area (acres)	Inlet C Coefficient	Inlet CA (acres)	System Contributing Area (acres)	Ex-ternal Tc (min)	System Flow Time (min)	System In-tensity (in/hr)	System Rational Flow (cfs)	Ad-ditional Flow (cfs)	Total System Flow (cfs)	Local In-tensity (in/hr)	Local Rational Flow (cfs)	HGL In (ft)	HGL Out (ft)	Rim Elevation (ft)
E-1	0.14	0.85	0.12	0.12	0	5	3.13	0.38	0	0.38	3.13	0.38	97.14	97.12	98.5
E-2	3.27	0.85	2.78	2.9	0	12.23	2.11	6.15	0	6.15	4.18	11.71	96.6	96.54	98.2
E-3	2.7	0.85	2.29	5.19	0	13.68	1.97	10.29	0	10.29	4.18	9.67	96.39	96.29	98
E-4	0.2	0.85	0.17	5.36	0	16.02	1.78	9.61	0	9.61	4.18	0.72	95.83	95.77	98
E-5	1.86	0.85	1.58	9.19	0	16.63	1.74	16.11	0	16.11	4.18	6.66	95.72	95.64	98
E-6	0.23	0.85	0.2	29.38	0	16.99	1.72	50.84	0	50.84	4.18	0.82	95.61	95.35	98
E-7	1.78	0.85	1.51	30.9	0	18.3	1.64	50.93	0	50.93	4.18	6.37	94.89	94.63	97.8
E-8	0.96	0.85	0.82	37.6	0	18.82	1.6	60.75	0	60.75	4.18	3.44	94.45	94.09	97.7
E-9	1.14	0.85	0.97	57.09	0	19.21	1.58	90.86	0	90.86	4.18	4.08	93.85	93.06	97.6
E1-1	0.4	0.85	0.34	0.34	0	5	3.13	1.07	0	1.07	3.13	1.07	97.05	96.99	98.8
E1-2	2.03	0.85	1.73	2.24	0	8.87	2.48	5.61	0	5.61	4.18	7.27	95.92	95.89	98.6
E2-1	0.21	0.85	0.18	0.18	0	5	3.13	0.56	0	0.56	3.13	0.56	96.12	96.1	98.3
E3-1	0.35	0.85	0.3	0.3	0	5	3.13	0.94	0	0.94	3.13	0.94	97.79	97.77	98.9
E3-2	15.85	0.85	13.47	13.77	0	10.36	2.29	31.72	0	31.72	4.18	56.77	97.54	97.23	98.5
E3-3	1.1	0.85	0.94	14.71	0	11.28	2.2	32.57	0	32.57	4.18	3.94	96.59	96.41	98.3
E3-4	6.23	0.85	5.3	20	0	12.43	2.09	42.08	0	42.08	4.18	22.31	96.12	95.83	98
E4-1	1.86	0.85	1.58	1.58	0	5	3.13	4.99	0	4.99	3.13	4.99	96.55	96.51	97.6
E4-2	1.52	0.85	1.29	2.87	0	6.73	2.79	8.07	0	8.07	4.18	5.44	96.41	96.31	97.7
E4-3	0.99	0.85	0.84	3.71	0	7.89	2.62	9.79	0	9.79	4.18	3.55	96.05	95.9	97.8
E4-4	2.55	0.85	2.17	5.88	0	9.5	2.39	14.17	0	14.17	4.18	9.13	95.24	94.93	97.7
E5-1	2.62	0.85	2.23	2.23	0	6	2.92	6.55	0	6.55	2.92	6.55	99.86	99.79	101.2
E5-2	2.71	0.85	2.3	4.53	0	7.6	2.66	12.13	0	12.13	4.18	9.71	99.6	99.37	100.9
E5-3	2.94	0.85	2.5	7.03	0	8.64	2.51	17.79	0	17.79	4.18	10.53	98.57	98.36	100.3
E5-4	2.22	0.85	1.89	8.92	0	9.72	2.36	21.21	0	21.21	4.18	7.95	97.85	97.56	99.6
E5-5	3.02	0.85	2.57	11.48	0	10.51	2.27	26.29	0	26.29	4.18	10.82	96.92	96.62	98.7
E5-6	3.48	0.85	2.96	14.44	0	11.31	2.19	31.94	0	31.94	4.18	12.46	96.01	95.69	98.3
E5-7	0.82	0.85	0.7	15.14	0	11.82	2.15	32.73	0	32.73	4.18	2.94	95.32	94.99	98
E5-8	3.99	0.85	3.39	18.53	0	12.25	2.1	39.3	0	39.3	4.18	14.29	94.66	94.18	97.7
Outlet				57.09		19.43	1.57	90.07		90.07			92.3	92.3	98.1

February 11, 2000

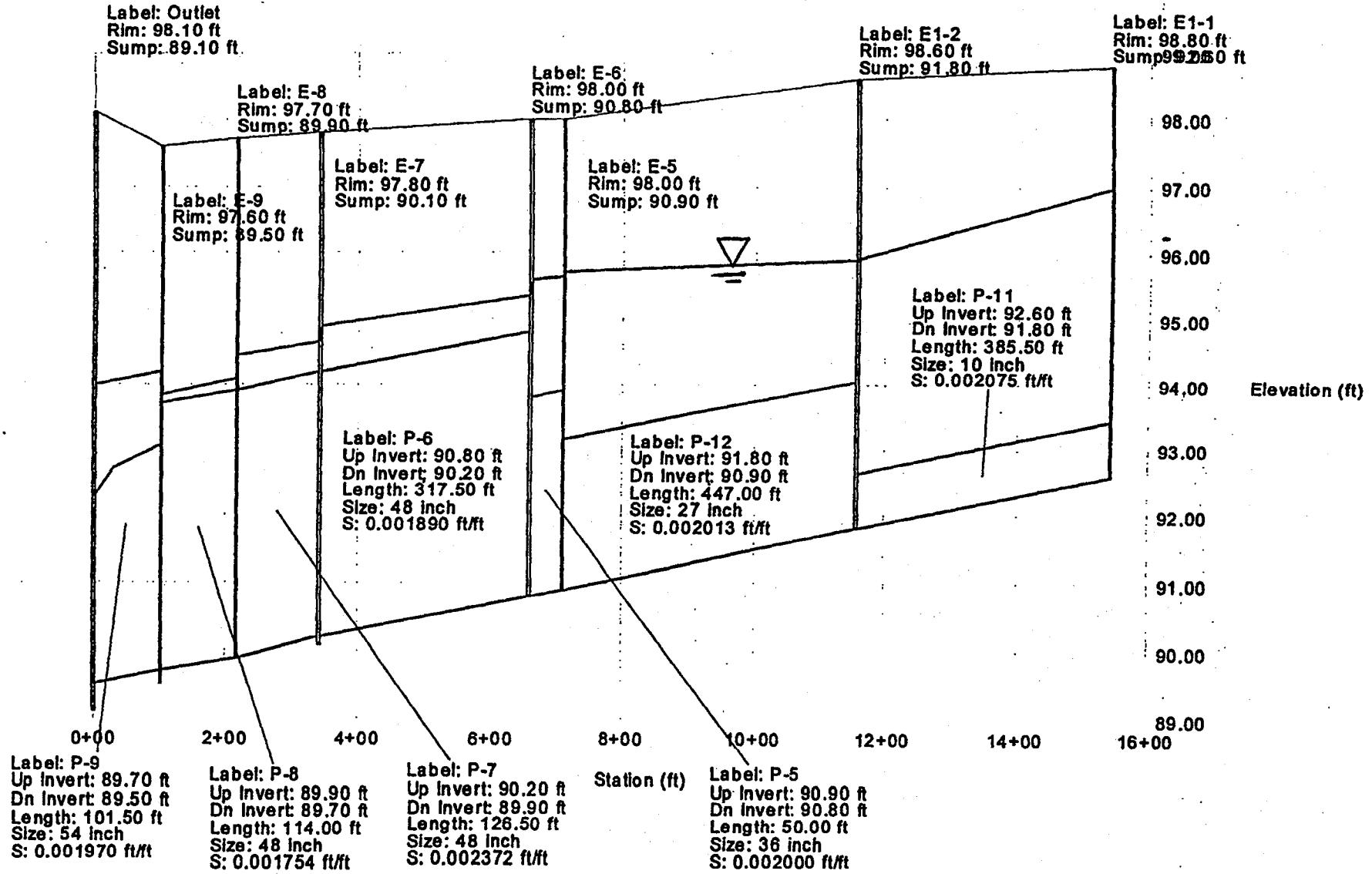
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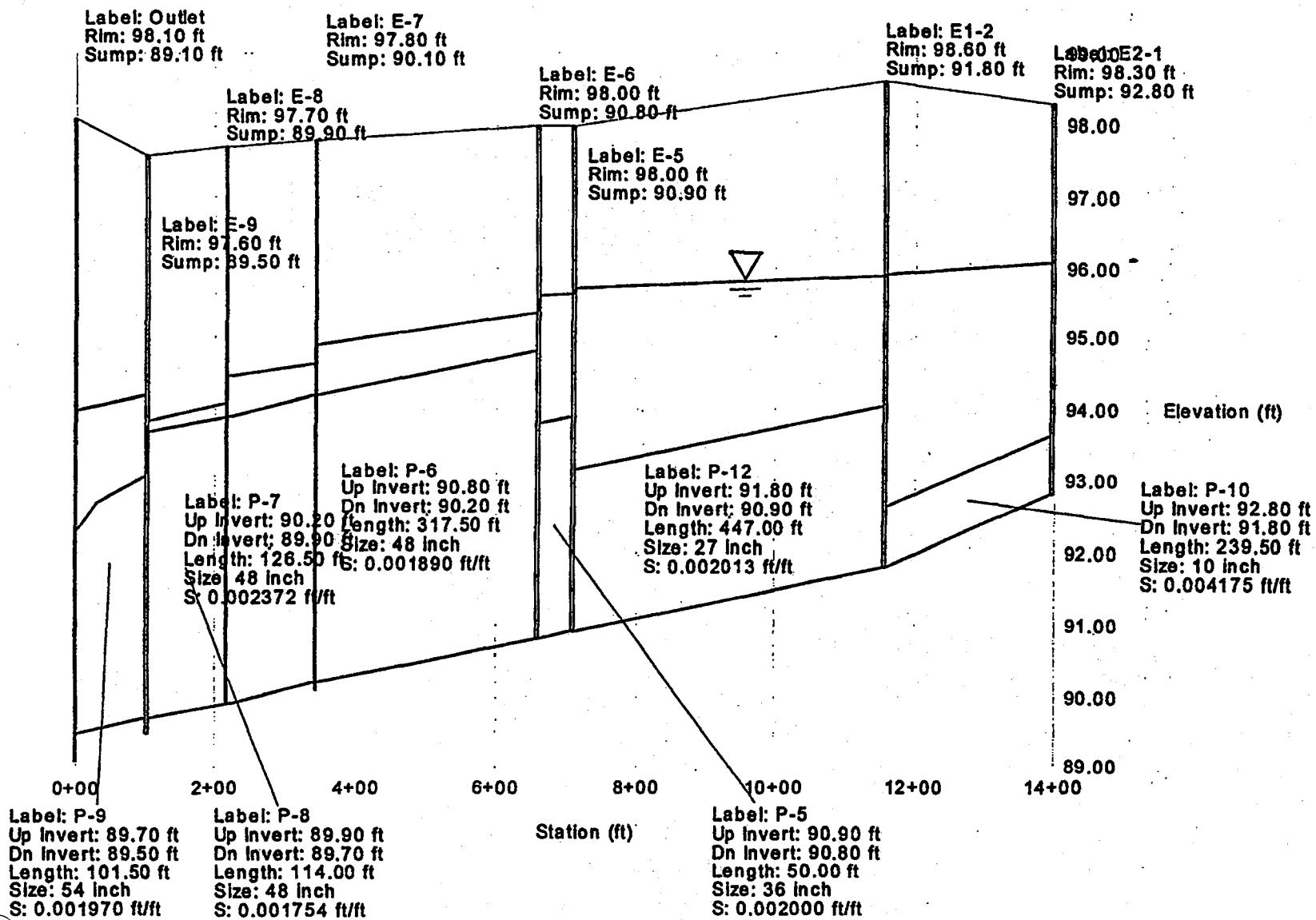
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Scenario: Base



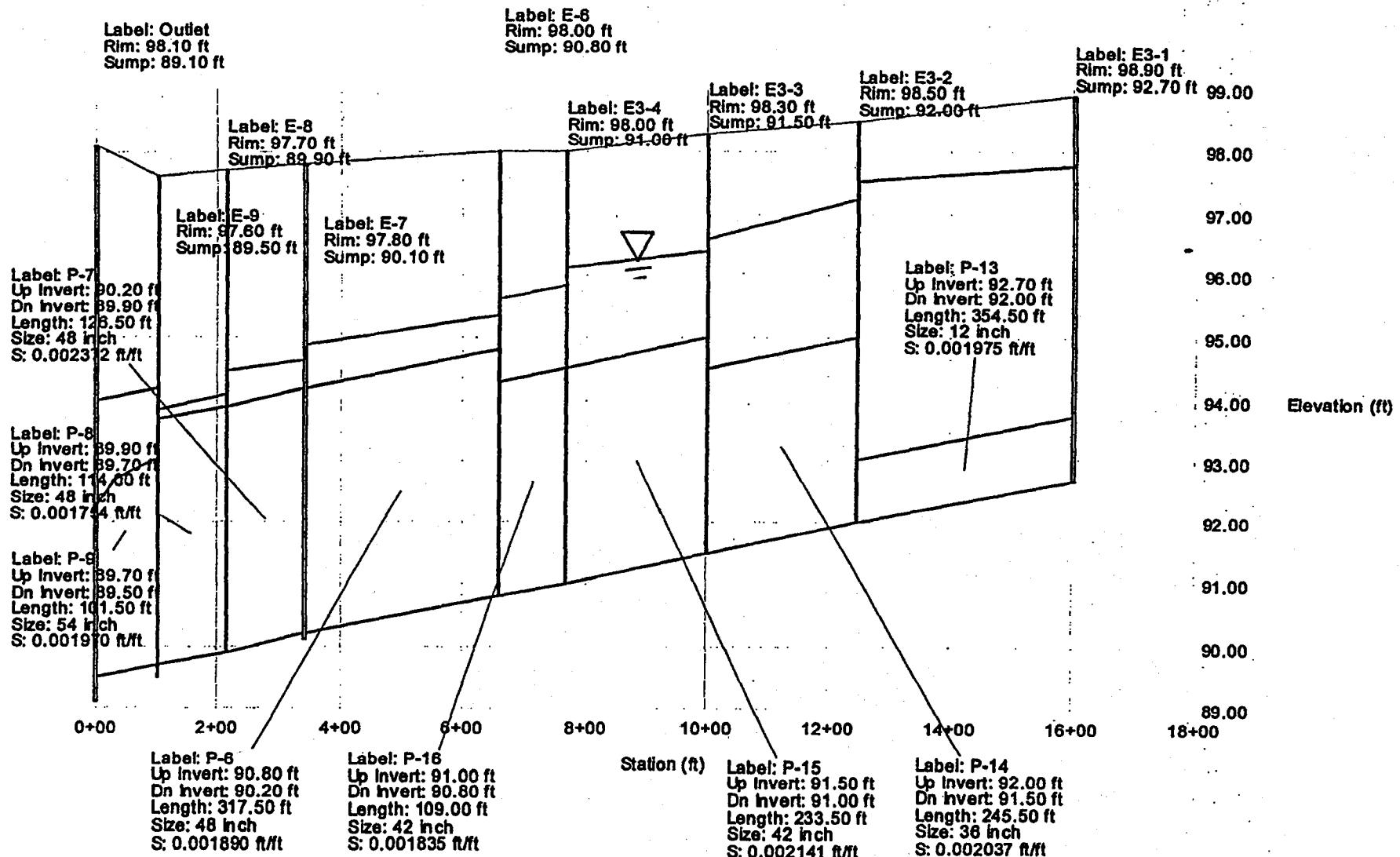
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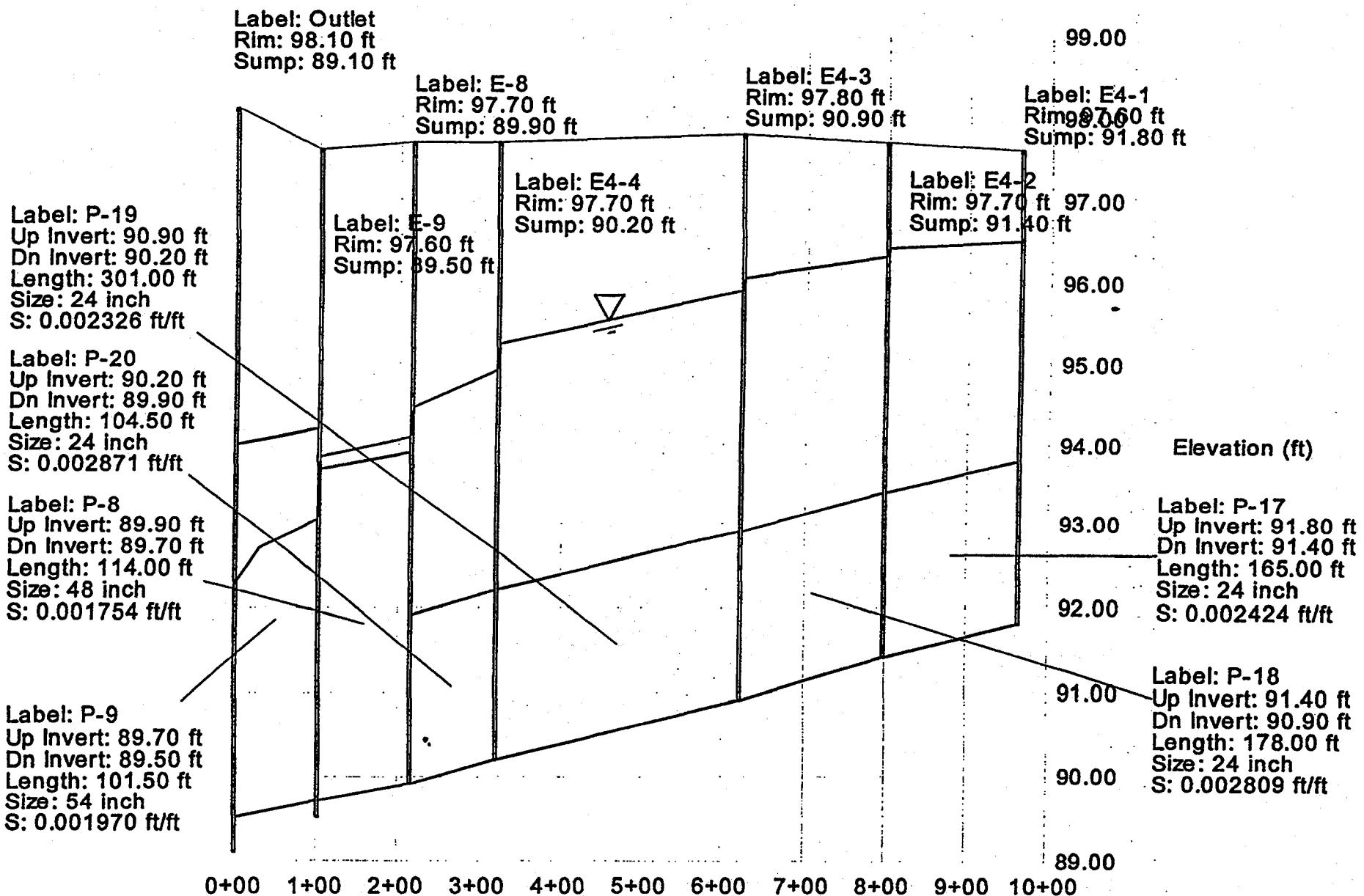
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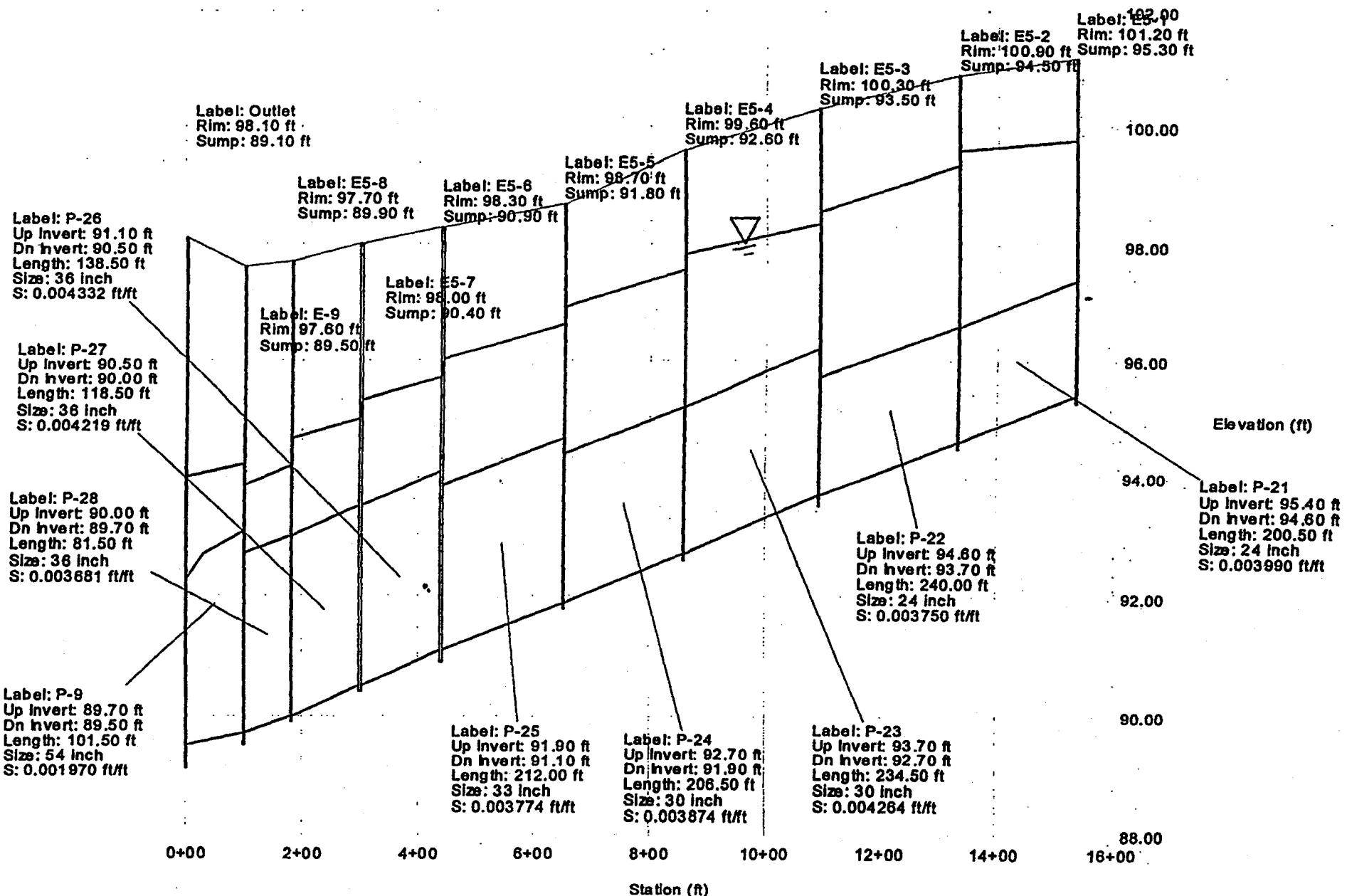
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Profile
Scenario: Base



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Scenario: Base



SUPPLEMENTAL
HYDROLOGY AND HYDRAULIC
CALCULATIONS

for the
MISSION BAY PROJECT

Including

Iterative Overland Flow Calculations
Basin 4 – Steepest Slopes
Basin 2 – Flattest Slopes

and

Backwater Curve (HGL) for Overland Flow
Basin 4 – Initial Grades

Prepared for :



CATELLUS

MARCH 15, 2000



INITIAL (PRE-SETTLEMENT)GRADES

Given: Run-off generated by the 5 year design storm, and only run-off generated by the 5 year design storm, will be carried away by the underground storm drain system.

Find: The depth of flow in surface streets generated by excess run-off during the 100 year storm event.

Watersheds: Watersheds are based on initial (pre-settlement) grades, as established on the *Conceptual Grading Plan* prepared by Santina & Thompson Inc. and Hawk Engineers Inc. dated March 15, 2000. The *Watershed Map for Overland Flow based on Initial (Pre-Settlement) Grades* dated March 15, 2000 indicates the proposed drainage basins, direction of flow, drainage areas, and street slopes, used in these calculations. Basin numbers referenced below refer to the Watershed Map. Sub-areas are as indicated on the attached figures. Sub-area boundaries have been defined by changes in street slope, which correspond to changes in street flow velocity. Basin 4 (the steepest street slopes) and Basin 2 (the flattest street slopes) were selected for sample analysis.

Standards: All calculations are in accordance with Section XVIII "Required Capacity of Separated Storm Drain System" of the *Mission Bay Subdivision Regulations* dated 1998.

Intensities: 5 Year rainfall intensities are taken from the tabulation entitled "San Francisco Rainfall Rate Table 1941" Plan L-3903.4, dated February 1941, and subsequent revisions, as required by the above document. 100 Year rainfall intensities are from the California State Department of Water Resources (CSDWR), developed by Jim Goodridge using Federal Rainfall records in San Francisco. Provided by Leah Orloff of the San Francisco Public Utilities Commission.

Time (minutes)	Intensity 100 Year	Intensity 5 Year	Intensity 100-5 Year
5	4.800	3.126	1.674
6	4.390	2.922	1.468
7	4.240	2.742	1.498
10	3.420	2.316	1.104
15	2.800	1.840	0.960
20	2.370	1.526	0.844
25	2.090	1.303	0.787
30	1.800	1.137	0.663
35	1.730	1.009	0.721
40	1.600	0.918	0.682
45	1.500	0.856	0.644
50	1.420	0.805	0.615
55	1.340	0.762	0.578
60	1.280	0.723	0.557
65	1.230	0.690	0.540
70	1.180	0.661	0.519
75	1.130	0.635	0.495
80	1.100	0.611	0.489
85	1.060	0.590	0.470
90	1.030	0.570	0.460

Calculations: All run-off calculations have been performed using the "Rational Method". Initial time of concentration was calculated as the sum of the time to reach the gutter (3 minutes) and the travel time in the gutter (length/velocity). Time of concentration was then accumulated from sub-area to sub-area by adding successive travel times. Iterative calculations were performed such that the velocity ultimately used in hydrologic (to determine quantity of flow) calculations was identical to the velocity produced by the hydraulic (to determine depth of flow in streets) calculations. This was done to confirm that the assumed velocity of 1.5 fps, which was used in the February 11, 2000 study, was in fact conservative as intended.

Coefficient: Table 1 "Coefficients of Run-Off And Inlet Times" contained in the Mission Bay Subdivision Regulations requires a coefficient of 0.80 to 0.96 for "commercial" areas. A coefficient of 0.85 has been selected based on the future development of the area.

Hydrology (Quantify Flows)

Basin 4 - Area 1 Fourth Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	200	200	5	5	1.674	0.95	0.95	0.81	1.4	104.16	3.39	-1.89
2	3.39	200	200	5	5	1.674	0.95	0.95	0.81	1.4	104.16	3.39	0

Basin 4 - Area 2 16th Street (east of Fourth St.)

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	630	830	7	12	1.05	5.34	6.29	5.35	5.6	103.08	1.29	0.21
2	1.29	630	830	8	13	1.02	5.34	6.29	5.35	5.4	103.08	1.28	0.01
3	1.28	630	830	8	13	1.02	5.34	6.29	5.35	5.4	103.08	1.28	0

Basin 4 - Area 3 16th Street (east of Owens Street)

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	400	1230	4	17	0.91	5.34	11.63	9.89	9.0	102.36	1.26	0.24
2	1.26	400	1230	5	18	0.890	5.34	11.63	9.89	8.8	102.36	1.25	0.01
3	1.25	400	1230	5	18	0.890	5.34	11.63	9.89	8.8	102.36	1.25	0

Basin 4 - Area 4 Owens Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	250	250	6	6	1.47	3.40	3.40	2.89	4.2	105.44	3.52	-2.02
2	3.52	250	250	4	4	1.67	3.40	3.40	2.89	4.8	105.44	3.60	-0.08
3	3.60	250	250	4	4	1.674	3.40	3.40	2.89	4.8	105.44	3.60	0

Basin 4 - Area 5 Owens Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	280	530	3	7	1.5	4.00	7.40	6.29	9.4	104.00	2.18	-0.68
2	2.18	280	530	2	6	1.47	4.00	7.40	6.29	9.2	103.99	2.17	0.01
3	2.17	280	530	2	6	1.47	4.00	7.40	6.29	9.2	103.99	2.17	0

Basin 4 - Area 6 Owens Street (south of 16th Street)

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	320	850	4	10	1.1	3.84	11.24	9.55	10.5	102.30	2.09	-0.59
2	2.09	320	850	3	9	1.24	3.84	11.24	9.55	11.8	102.32	2.15	-0.06
3	2.15	320	850	2	8	1.37	3.84	11.24	9.55	13.1	102.33	2.20	-0.05
4	2.20	320	850	2	8	1.37	3.84	11.24	9.55	13.1	102.33	2.20	0

Basin 4 - Area 7 Owens Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	410	1640	5	23	0.810	3.12	25.99	22.1	17.9	102.39	1.05	0.45
2	1.05	410	1640	7	25	0.79	3.12	25.99	22.1	17.4	102.35	1.07	-0.02
3	1.07	410	1640	6	24	0.8	3.12	25.99	22.1	17.6	102.35	1.07	0

Basin 4 - Area 8 Owens Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	120	1760	1	25	0.79	1.56	27.55	23.4	18.4	101.58	2.36	-0.86
2	2.36	120	1760	1	25	0.79	1.56	27.55	23.4	18.4	101.58	2.36	0

Basin 4 - Area 9 Owens Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	320	2080	4	29	0.688	3.65	31.20	26.5	18.2	101.29	1.43	0.07
2	1.43	320	2080	4	29	0.688	3.65	31.20	26.5	18.2	101.29	1.43	0

Basin 4 - Area 10 Owens Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	130	2210	1	30	0.663	1.72	32.92	28	18.6	100.58	2.36	-0.86
2	2.36	130	2210	1	30	0.663	1.72	32.92	28	18.6	100.58	2.36	0

Basin 4 - Area 11 Owens Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	240	2450	3	33	0.698	2.18	35.10	29.8	20.8	100.05	1.88	-0.38
2	1.88	240	2450	2	32	0.686	2.18	35.10	29.8	20.5	100.05	1.87	0.01
3	1.87	240	2450	2	32	0.686	2.18	35.10	29.8	20.5	100.05	1.87	0

Basin 4 - Area 12 Owens Street

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	180	2630	2	34	0.709	2.39	37.49	31.9	22.6	99.23	2.34	-0.84
2	2.34	180	2630	1	33	0.698	2.39	37.49	31.9	22.2	99.22	2.34	0

Basin 4 - Area 13 Owens Street (south of the Round About)

Iteration	Overland Flow Calcs								Open Channel Calcs				
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	320	2950	4	37	0.71	4.25	41.74	35.5	25.0	98.69	1.89	-0.39
2	1.89	320	2950	3	36	0.71	4.25	41.74	35.5	25.3	98.70	1.90	-0.01
3	1.90	320	2950	3	36	0.71	4.25	41.74	35.5	25.3	98.70	1.90	0

Basin 2 - Area 1 Illinois Street (north of Mariposa Street)

Iteration	Overland Flow Calcs									Open Channel Calcs			
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	850	850	12	12	1.05	4.86	4.86	4.13	4.3	100.60	0.50	1.00
2	0.50	850	850	31	31	0.68	4.86	4.86	4.13	2.8	100.54	0.44	0.06
3	0.44	850	850	35	35	0.72	4.86	4.86	4.13	3.0	100.55	0.45	-0.01
4	0.45	850	850	34	34	0.71	4.86	4.86	4.13	2.9	100.55	0.45	0

Basin 2 - Area 2 Terry François Boulevard

Iteration	Overland Flow Calcs									Open Channel Calcs			
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	450	1300	5	39	0.690	1.81	6.67	5.67	3.9	100.20	0.78	0.72
2	0.78	450	1300	10	44	0.65	1.81	6.67	5.67	3.7	100.20	0.77	0.01
3	0.77	450	1300	10	44	0.65	1.81	6.67	5.67	3.7	100.20	0.77	0

Basin 2 - Area 3 16th Street (west of Terry François Boulevard)

Iteration	Overland Flow Calcs									Open Channel Calcs			
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	800	800	12	12	1.05	2.94	2.94	2.50	2.6	100.63	0.44	1.06
2	0.44	800	800	33	33	0.7	2.94	2.94	2.50	1.7	100.58	0.40	0.04
3	0.40	800	800	36	36	0.71	2.94	2.94	2.50	1.8	100.58	0.40	0.00

Basin 2 - Area 4 Terry François Boulevard (at lowpoint)

Iteration	Overland Flow Calcs									Open Channel Calcs			
	V1	L	ΣL	Travel	tc	I	A	ΣA	ΣCA	Q	Y	V2	V1-V2
1	1.50	750	1550	8	44	0.65	5.74	15.35	13	8.5	100.34	0.81	0.69
2	0.81	750	1550	15	51	0.61	5.74	15.35	13	7.9	100.33	0.80	0.01
3	0.80	750	1550	16	52	0.6	5.74	15.35	13	7.8	100.33	0.79	0.01
4	0.79	750	1550	16	52	0.6	5.74	15.35	13	7.8	100.33	0.79	0.00

Hydraulics/Open Channel Flow (Determine Flow Depth)

Given: Peak 100 Year less 5 Year flows established in the above section.

Find: Depth of flow in selected streets. Street geometry is based upon the *South of Channel Infrastructure Plan* prepared by KCA Engineers, Inc. in September 1998. Street cross slopes are conservatively assumed at 2%, gutter cross slope is assumed at 8% (SF Standard Details permit gutter cross-slope to match street cross-slope), and sidewalk cross slope is assumed at 1/5 inch per foot in accordance with the *Mission Bay Subdivision Regulations*. All top of curb elevations and street longitudinal slopes (channel slope) are based on the initial (pre-settlement) grades established on the *Conceptual Grading Plan* prepared by Santina & Thompson, Inc. and Hawk Engineers, Inc. dated March 15, 2000, and shown on the *Watershed Map for Overland Flow based on Initial (Pre-Settlement) Grades* dated March 15, 2000.

Manning's "n" is assumed as 0.016 for all streets.

Calcs: Channel flow calculations performed by Civil Tools v2.4.

Basin 4 – Area 1: Fourth Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

Q (CFS) ? 1.4
S (FT/FT) ? 0.0381

CROSS-SECTION POINTS
DIST ELEV COEFF

RESULTS			
Y= 104.16 FT	13.6	104.12	.016
A= 0.41 SF	37.1	104.59	.016
P= 7.79 FT	60.6	104.12	.016
V= 3.39 FPS	62.1	104.00	.016
F= 2.54 SUPER-CRITICAL FLOW	62.1	104.50	.016

	0	106.00	.016
	0	104.70	.016
	12.1	104.50	.016
	12.1	104.00	.016
	13.6	104.12	.016
	37.1	104.59	.016
	60.6	104.12	.016
	62.1	104.00	.016
	62.1	104.50	.016
	74.2	104.70	.016
	74.2	106.00	.016

Basin 4 – Area 2: 16th Street (at Fourth Street)

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 5.4
S (FT/FT) ? 0.0021**

CROSS-SECTION POINTS
DIST ELEV COEFF

RESULTS

**Y= 103.08 FT
A= 4.22 SF
P= 29.35 FT
V= 1.28 FPS
F= 0.59 SUB-CRITICAL FLOW**

0	105.00	.016
0	103.40	.016
12.1	<u>103.20</u>	.016
12.1	102.70	.016
13.6	102.82	.016
37.1	103.29	.016
60.6	102.82	.016
62.1	102.70	.016
62.1	<u>103.20</u>	.016
74.2	103.40	.016
74.2	105.00	.016

Basin 4 – Area 3: 16th Street (east of Owens Street)

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

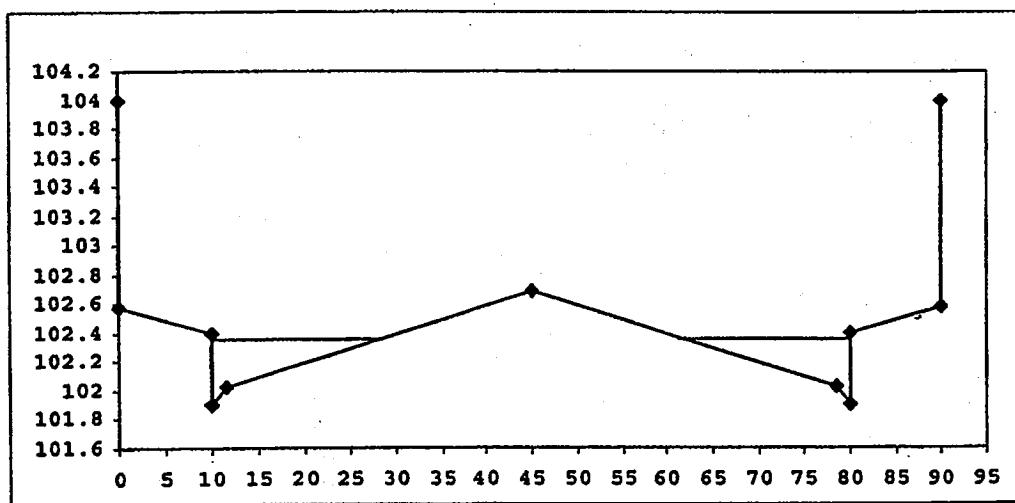
**Q (CFS) ? 8.8
 S (FT/FT) ? 0.0015**

**CROSS-SECTION POINTS
 DIST ELEV COEFF**

RESULTS

**Y= 102.36 FT
 A= 7.03 SF
 P= 38.08 FT
 V= 1.25 FPS
 F= 0.51 SUB-CRITICAL FLOW**

0	104.00	.016
0	102.57	.016
10	<u>102.40</u>	.016
10	101.90	.016
11.5	102.02	.016
45	102.69	.016
78.5	102.02	.016
80	101.90	.016
80	<u>102.40</u>	.016
90	102.57	.016
90	104.00	.016



Basin 4 – Area 4: Owens Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 4.8
 S (FT/FT) ? 0.0292**

CROSS-SECTION POINTS
DIST ELEV COEFF

RESULTS

**Y= 105.44 FT
 A= 1.33 SF
 P= 15.99 FT
 V= 3.60 FPS
 F= 2.16 SUPER-CRITICAL FLOW**

DIST	ELEV	COEFF
0	107.00	.016
0	105.90	.016
12	105.70	.016
12	105.20	.016
13.5	105.32	.016
34	105.73	.016
54.5	105.32	.016
56	105.20	.016
56	105.70	.016
68	105.90	.016
68	107.00	.016

Basin 4 – Area 5: Owens Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 9.2
 S (FT/FT) ? 0.0055**

CROSS-SECTION POINTS
DIST ELEV COEFF

RESULTS

**Y= 103.99 FT
 A= 4.24 SF
 P= 27.58 FT
 V= 2.17 FPS
 F= 0.96 SUB-CRITICAL FLOW**

DIST	ELEV	COEFF
0	106.00	.016
0	104.30	.016
12	104.10	.016
12	103.60	.016
13.5	103.72	.016
34	104.19	.016
54.5	103.72	.016
56	103.60	.016
56	104.10	.016
68	104.30	.016
68	106.00	.016

Basin 4 – Area 6: Owens Street (south of 16th Street)

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

Q (CFS) ? 13.1

S (FT/FT) ? 0.0051

RESULTS

Y= 102.33 FT

A= 5.96 SF

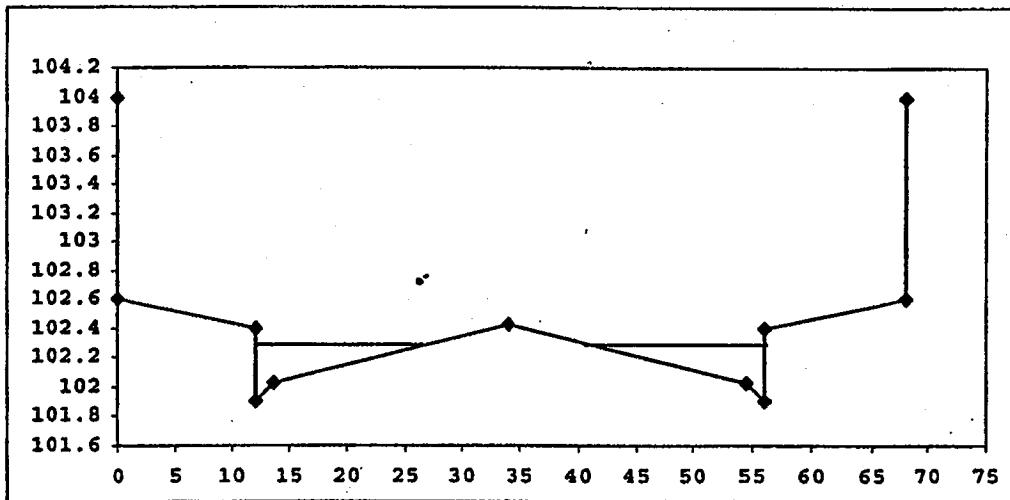
P= 35.00 FT

V= 2.20 FPS

F= 0.93 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

0	104.00	.016
0	102.60	.016
12	102.40	.016
12	101.90	.016
13.5	102.02	.016
34	102.43	.016
54.5	102.02	.016
56	101.90	.016
56	102.40	.016
68	102.60	.016
68	104.00	.016



Basin 4 – Area 7: Owens Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 17.6
S (FT/FT) ? 0.0006**

**CROSS-SECTION POINTS
DIST ELEV COEFF**

RESULTS

**Y= 102.35 FT
A= 16.38 SF
P= 62.89 FT
V= 1.07 FPS
F= 0.37 SUB-CRITICAL FLOW**

	DIST	ELEV	COEFF
	0	104.00	.016
	0	102.40	.016
	12	<u>102.20</u>	.016
	12	101.70	.016
	13.5	101.82	.016
	34	102.23	.016
	54.5	101.82	.016
	56	101.70	.016
	56	<u>102.20</u>	.016
	68	102.40	.016
	68	104.00	.016

Basin 4 – Area 8: Owens Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 18.4
S (FT/FT) ? 0.0050**

**CROSS-SECTION POINTS
DIST ELEV COEFF**

RESULTS

**Y= 101.58 FT
A= 7.81 SF
P= 40.15 FT
V= 2.36 FPS
F= 0.93 SUB-CRITICAL FLOW**

	DIST	ELEV	COEFF
	0	103.00	.016
	0	101.80	.016
	12	<u>101.60</u>	.016
	12	101.10	.016
	13.5	101.22	.016
	34	101.63	.016
	54.5	101.22	.016
	56	101.10	.016
	56	<u>101.60</u>	.016
	68	101.80	.016
	68	103.00	.016

Basin 4 – Area 9: Owens Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 18.2
S (FT/FT) ? 0.0013**

RESULTS

**Y= 101.29 FT
A= 12.70 SF
P= 55.28 FT
V= 1.43 FPS
F= 0.52 SUB-CRITICAL FLOW**

**CROSS-SECTION POINTS
DIST ELEV COEFF**

0	103.00	.016
0	101.40	.016
12	<u>101.20</u>	.016
12	100.70	.016
13.5	100.82	.016
34	101.23	.016
54.5	100.82	.016
56	100.70	.016
56	<u>101.20</u>	.016
68	101.40	.016
68	103.00	.016

Basin 4 – Area 10: Owens Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 18.6
S (FT/FT) ? 0.0050**

RESULTS

**Y= 100.58 FT
A= 7.87 SF
P= 40.32 FT
V= 2.36 FPS
F= 0.93 SUB-CRITICAL FLOW**

**CROSS-SECTION POINTS
DIST ELEV COEFF**

0	102.00	.016
0	100.80	.016
12	<u>100.60</u>	.016
12	100.10	.016
13.5	100.22	.016
34	100.63	.016
54.5	100.22	.016
56	100.10	.016
56	<u>100.60</u>	.016
68	100.80	.016
68	102.00	.016

Basin 4 – Area 11: Owens Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 20.5
S (FT/FT) ? 0.0025**

**CROSS-SECTION POINTS
DIST ELEV COEFF**

RESULTS

**Y= 100.05 FT
A= 10.98 SF
P= 51.34 FT
V= 1.87 FPS
F= 0.70 SUB-CRITICAL FLOW**

0	102.00	.016
0	100.20	.016
12	<u>100.00</u>	.016
12	99.50	.016
13.5	99.62	.016
34	100.03	.016
54.5	99.62	.016
56	99.50	.016
56	<u>100.00</u>	.016
68	100.20	.016
68	102.00	.016

Basin 4 – Area 12: Owens Street

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

**Q (CFS) ? 22.2
S (FT/FT) ? 0.0044**

**CROSS-SECTION POINTS
DIST ELEV COEFF**

RESULTS

**Y= 99.22 FT
A= 9.50 SF
P= 46.89 FT
V= 2.34 FPS
F= 0.90 SUB-CRITICAL FLOW**

0	101.00	.016
0	99.40	.016
12	<u>99.20</u>	.016
12	98.70	.016
13.5	98.82	.016
34	99.23	.016
54.5	98.82	.016
56	98.70	.016
56	<u>99.20</u>	.016
68	99.40	.016
68	101.00	.016

Basin 4 – Area 13: Owens Street (south of Round About)

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

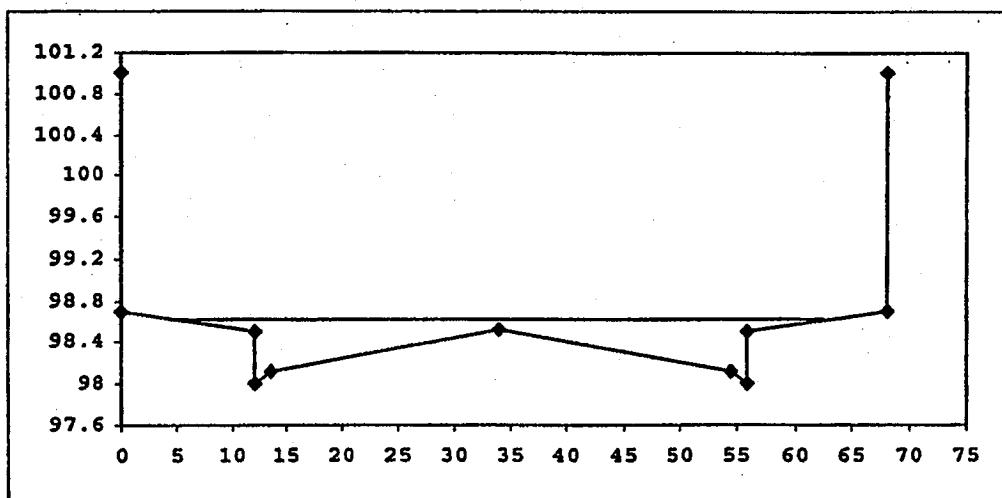
**Q (CFS) ? 25.3
S (FT/FT) ? 0.0022**

**CROSS-SECTION POINTS
DIST ELEV COEFF**

RESULTS

**Y= 98.60 FT
A= 13.31 SF
P= 56.62 FT
V= 1.90 FPS
F= 0.68 SUB-CRITICAL FLOW**

	DIST	ELEV	COEFF
	0	101.00	.016
	0	98.70	.016
	12	98.50	.016
	12	98.00	.016
	13.5	98.12	.016
	34	98.53	.016
	54.5	98.12	.016
	56	98.00	.016
	56	98.50	.016
	68	98.70	.016
	68	101.00	.016



Basin 2 – Area 1: Illinois Street (north of Mariposa Street)

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

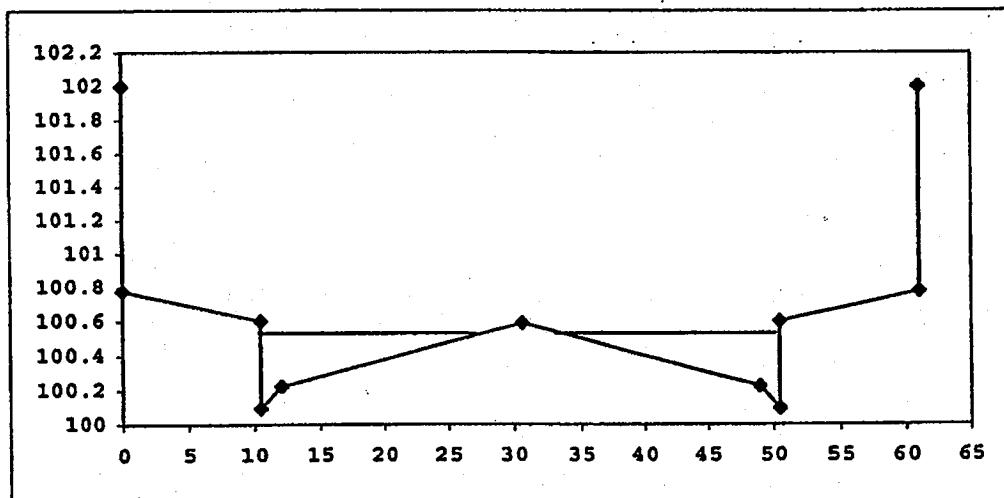
**Q (CFS) ? 2.9
S (FT/FT) ? 0.0002**

CROSS-SECTION POINTS
DIST ELEV COEFF

RESULTS

**Y= 100.55 FT
A= 6.49 SF
P= 36.57 FT
V= 0.45 FPS
F= 0.18 SUB-CRITICAL FLOW**

	DIST	ELEV	COEFF
	0	102.00	.016
	0	100.78	.016
	10.5	<u>100.60</u>	.016
	10.5	100.10	.016
	12	100.22	.016
	30.5	100.59	.016
	49	100.22	.016
	50.5	100.10	.016
	50.5	<u>100.60</u>	.016
	61	100.78	.016
	61	102.00	.016



Basin 2 – Area 2: Terry François Boulevard

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

Q (CFS) ? 3.7
S (FT/FT) ? 0.0007

RESULTS
Y= 100.20 FT
A= 4.82 SF
P= 31.43 FT
V= 0.77 FPS
F= 0.34 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

0	102.00	.016
0	100.51	.016
12.5	<u>100.30</u>	.016
12.5	99.80	.016
14	99.92	.016
46.5	100.57	.016
79	99.92	.016
80.5	99.80	.016
80.5	<u>100.30</u>	.016
96	100.56	.016
96	102.00	.016

Basin 2 – Area 3: 16th Street (west of Terry François Boulevard)

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

Q (CFS) ? 1.8
S (FT/FT) ? 0.0002

RESULTS
Y= 100.58 FT
A= 4.48 SF
P= 30.27 FT
V= 0.40 FPS
F= 0.18 SUB-CRITICAL FLOW

CROSS-SECTION POINTS
DIST ELEV COEFF

0	102.00	.016
0	100.87	.016
10	<u>100.70</u>	.016
10	100.20	.016
11.5	100.32	.016
45	100.99	.016
78.5	100.32	.016
80	100.20	.016
80	<u>100.70</u>	.016
90	100.87	.016
90	102.00	.016

Basin 2 – Area 4: Terry François Boulevard (at lowpoint)

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

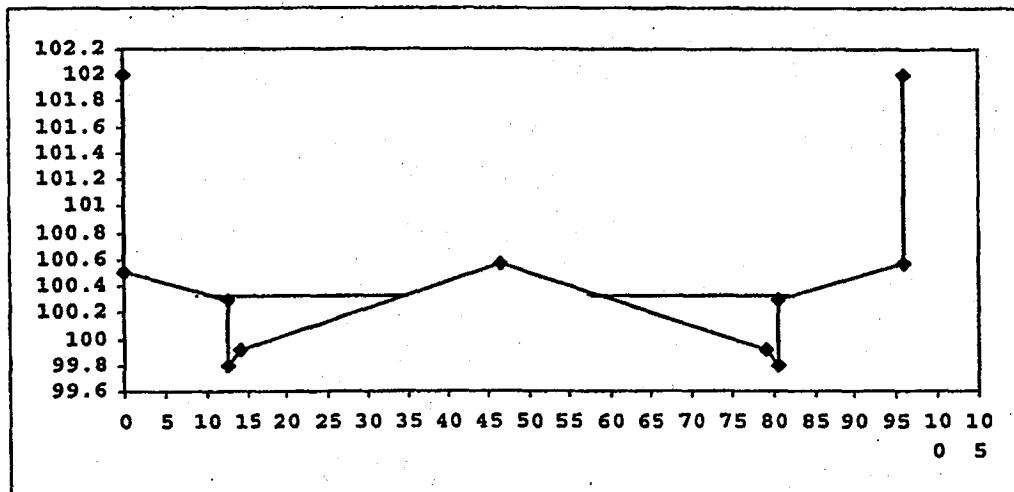
**Q (CFS) ? 7.8
S (FT/FT) ? 0.0005**

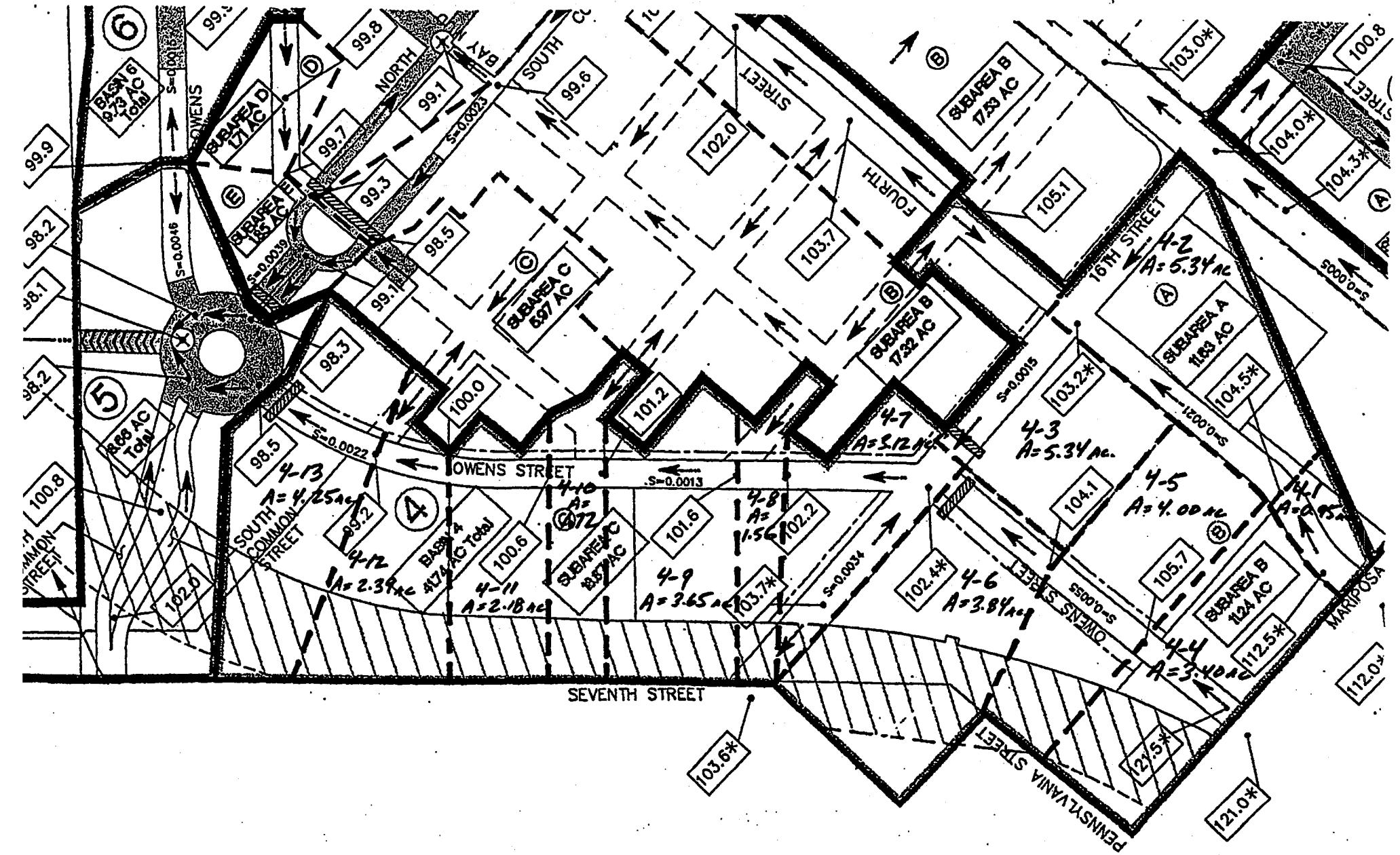
CROSS-SECTION POINTS
DIST ELEV COEFF

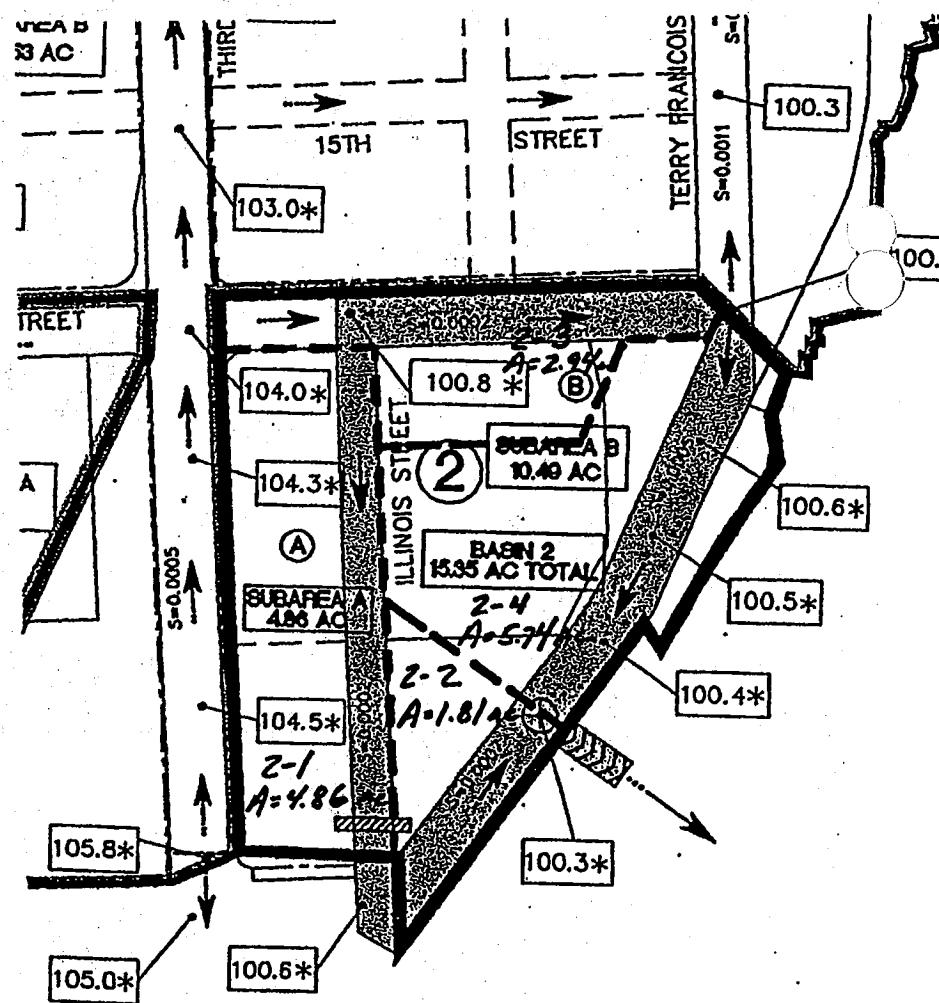
RESULTS

**Y= 100.33 FT
A= 9.83 SF
P= 48.39 FT
V= 0.79 FPS
F= 0.31 SUB-CRITICAL FLOW**

0	102.00	.016
0	100.51	.016
12.5	<u>100.30</u>	.016
12.5	99.80	.016
14	99.92	.016
46.5	100.57	.016
79	99.92	.016
80.5	99.80	.016
80.5	<u>100.30</u>	.016
96	100.56	.016
96	102.00	.016







Typical Backwater Curve
Owens Street, Initial Conditions
3/15/00

The following attachments present a typical backwater curve (Owens Street, initial conditions, from the Roundabout to 16th Street was used because this street had the most gentle slope). A slope of .001878 ft/ft was used at the backwater curve transition, even though the actual slope may be slightly steeper. This was done to make sure that the results were conservative.

As presented below, a simple normal flow calculation gives a water depth of 0.61 feet (98.71 feet minus 98.10 feet).

NATURAL CHANNELS

VARIABLES LIST:

Y - FLOW ELEVATION Q - FLOWRATE S - CHANNEL SLOPE

VARIABLE TO BE SOLVED (Y, Q OR S) ? Y

Enter up to 20 cross-section points.
Enter <Return> only for distance to end.

Q (CFS) ? 25.3

S (FT/FT) ? .001878

CROSS-SECTION POINTS					
DIST	ELEV	COEFF	DIST	ELEV	COEFF
0	101.00	.016	68	101.00	.016
0	98.80	.016	12	98.60	.016
			12	98.10	.016
			13.5	98.22	.016
			34	98.63	.016
			54.5	98.22	.016
			56	98.10	.016
			56	98.60	.016
			68	98.80	.016

RESULTS

=====

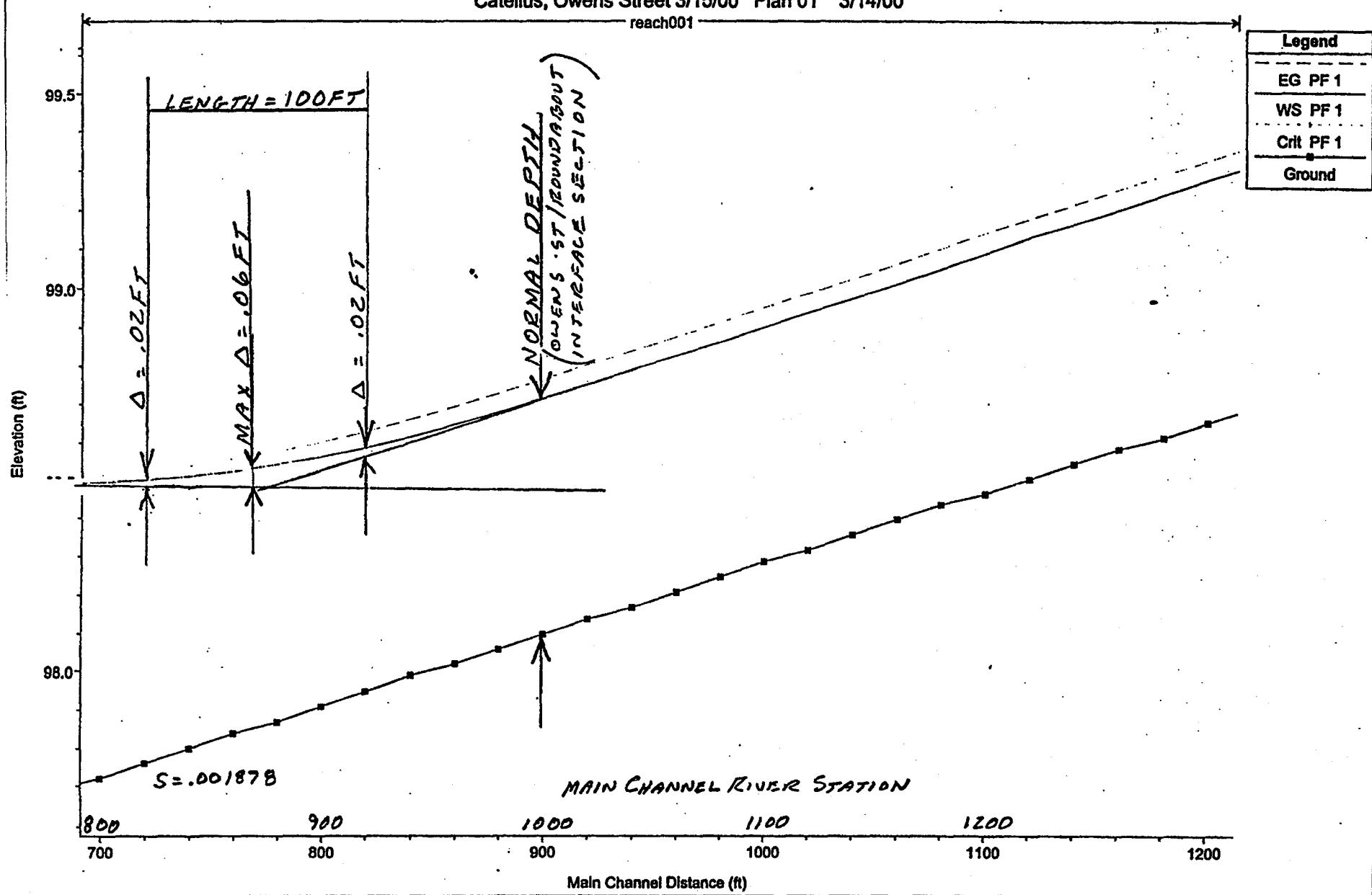
Y= 98.71 FT
A= 14.09 SF
P= 58.27 FT
V= 1.80 FPS
F= 0.64 SUB-CRITICAL FLOW

The following attachment shows that the backwater curve transition length is approximately 100 feet long and that the greatest error that would be incurred if the backwater curve were ignored would be .06 feet.

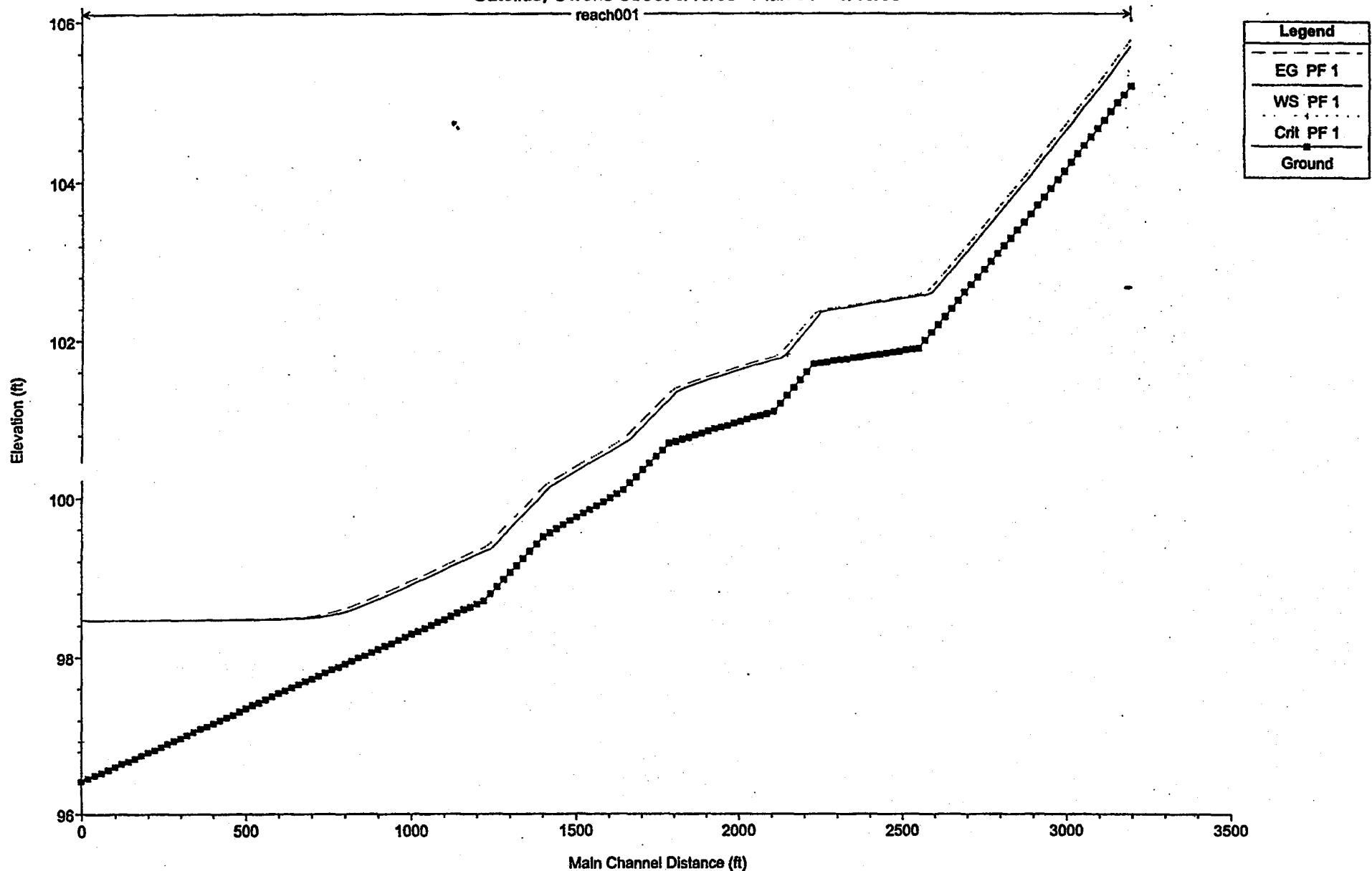
Catellus, Owens Street 3/15/00 Plan 01 3/14/00

reach001

Legend
EG PF 1
WS PF 1
Crit PF 1
Ground

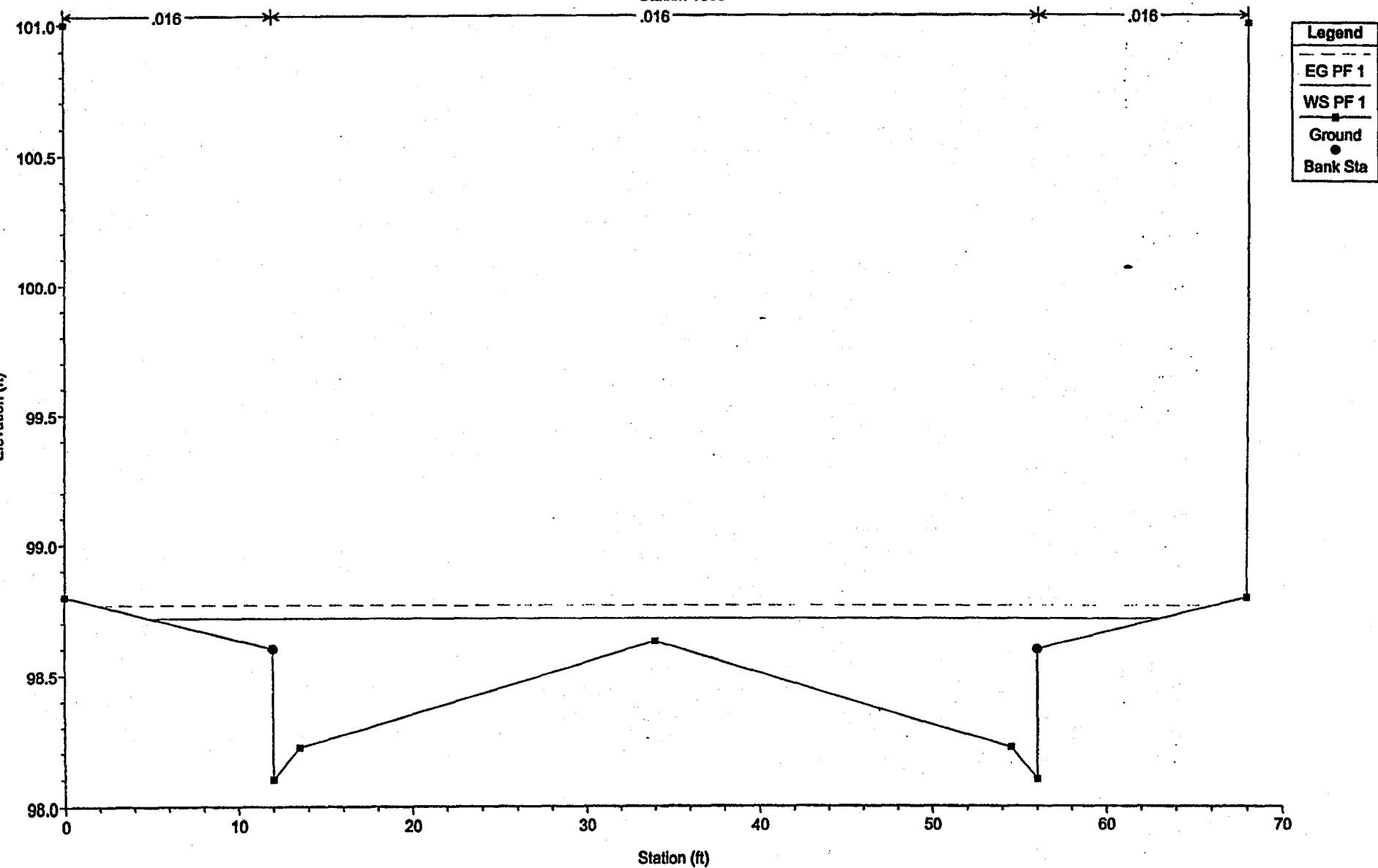


Catellus, Owens Street 3/15/00 Plan 01 3/15/00
reach001



Catellus, Owens Street 3/15/00 Plan 01 3/15/00

Station 1000



HEC-RAS Plan: co River: Owens Reach: reach001

Reach #	River Sta#	Q (Total)	Min Chl.Elev.	W.S. Elev.	Chl.W.S.	E.G. Elev.	E.G. Slope	Vel. Chnl.	Flow Area	Top Width	Froude # Chl.
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq. ft.)	(ft)	
reach001001	3280	18.00	105.20	105.68		105.76	0.005690	2.34	7.69	38.88	0.93
reach001002	3260	18.00	105.09	105.58		105.66	0.004856	2.20	8.16	40.08	0.86
reach001003	3240	18.00	104.99	105.47		105.55	0.005408	2.30	7.84	39.26	0.91
reach001004	3220	18.00	104.88	105.36		105.44	0.005690	2.34	7.69	38.88	0.93
reach001005	3200	18.00	104.77	105.26		105.34	0.004856	2.20	8.16	40.08	0.86
reach001006	3180	18.00	104.67	105.15		105.23	0.005408	2.30	7.84	39.26	0.91
reach001007	3160	18.00	104.56	105.04		105.12	0.005690	2.34	7.69	38.89	0.93
reach001008	3140	18.00	104.45	104.94		105.02	0.004856	2.20	8.16	40.08	0.86
reach001009	3120	18.00	104.35	104.83		104.91	0.005409	2.30	7.84	39.26	0.91
reach001010	3100	18.00	104.24	104.72		104.80	0.005687	2.34	7.69	38.89	0.93
reach001011	3080	18.00	104.13	104.62		104.70	0.004865	2.21	8.16	40.07	- 0.86
reach001012	3060	18.00	104.03	104.51		104.59	0.005385	2.29	7.85	39.30	0.90
reach001013	3040	18.00	103.92	104.40		104.48	0.005735	2.35	7.67	38.83	0.93
reach001014	3020	18.00	103.81	104.30		104.38	0.004675	2.17	8.28	40.37	0.85
reach001015	3000	18.00	103.71	104.19		104.27	0.005650	2.33	7.71	38.94	0.92
reach001016	2980	18.00	103.60	104.09		104.17	0.005000	2.23	8.08	39.86	0.87
reach001017	2960	18.00	103.50	103.99		104.07	0.005000	2.23	8.08	39.86	0.87
reach001018	2940	18.00	103.40	103.89		103.97	0.005000	2.23	8.08	39.86	0.87
reach001019	2920	18.00	103.30	103.79		103.87	0.005000	2.23	8.08	39.86	0.87
reach001020	2900	18.00	103.20	103.69		103.77	0.005000	2.23	8.08	39.86	0.87
reach001021	2880	18.00	103.10	103.59		103.67	0.005000	2.23	8.08	39.86	0.87
reach001022	2860	18.00	103.00	103.49		103.57	0.005000	2.23	8.08	39.86	0.87
reach001023	2840	18.00	102.90	103.39		103.47	0.005000	2.23	8.08	39.86	0.87
reach001024	2820	18.00	102.80	103.29		103.37	0.005000	2.23	8.08	39.86	0.87
reach001025	2800	18.00	102.70	103.19		103.27	0.005000	2.23	8.08	39.86	0.87
reach001026	2780	18.00	102.60	103.09		103.17	0.005001	2.23	8.07	39.86	0.87
reach001027	2760	18.00	102.50	102.99		103.07	0.004997	2.23	8.08	39.86	0.87
reach001028	2740	18.00	102.40	102.89		102.97	0.005011	2.23	8.07	39.84	0.87
reach001029	2720	18.00	102.30	102.79		102.87	0.004965	2.22	8.10	39.91	0.87
reach001030	2700	18.00	102.20	102.69		102.77	0.005107	2.25	8.01	39.70	0.88
reach001031	2680	18.00	102.10	102.59		102.67	0.004594	2.16	8.34	40.51	0.84
reach001032	2660	18.00	102.00	102.56		102.60	0.001908	1.60	11.40	51.31	0.56
reach001033	2640	18.00	101.90	102.55		102.57	0.000633	1.14	16.72	62.52	0.34
reach001034	2620	18.00	101.89	102.54		102.56	0.000653	1.15	16.53	62.18	0.34
reach001035	2600	18.00	101.88	102.53		102.55	0.000607	1.12	16.91	62.87	0.33
reach001036	2580	18.00	101.86	102.52		102.54	0.000819	1.13	16.85	62.77	0.34

HEC-RAS Plan: co River: Owens Reach: reach001 (Continued)

Reach	River Stat.	Q (ft ³ /sec)	Min Ch. Elevation (ft)	W.S. Elev.	Crit W.S.	E.G. Elev.	E.G. Slope	Vel. Chnl.	Flow Area (sq ft)	Top Width (ft)	Froude # Chnl.
reach001	2560	18.00	101.85	102.50		102.52	0.000637	1.14	16.68	62.44	0.34
reach001	2540	18.00	101.84	102.49		102.51	0.000659	1.15	16.48	62.06	0.35
reach001	2520	18.00	101.82	102.48		102.50	0.000643	1.14	16.63	61.97	0.34
reach001	2500	18.00	101.81	102.46		102.48	0.000630	1.14	16.75	62.57	0.34
reach001	2480	18.00	101.80	102.45		102.47	0.000650	1.15	16.56	62.21	0.34
reach001	2460	18.00	101.79	102.44		102.46	0.000674	1.16	16.35	61.80	0.35
reach001	2440	18.00	101.78	102.43		102.45	0.000663	1.15	16.44	62.34	0.35
reach001	2420	18.00	101.76	102.41		102.43	0.000650	1.15	16.57	62.22	0.34
reach001	2400	18.00	101.75	102.40		102.42	0.000674	1.16	16.35	61.80	0.35
reach001	2380	18.00	101.74	102.38		102.41	0.000704	1.18	16.10	61.31	0.36
reach001	2360	18.00	101.72	102.37		102.39	0.000737	1.19	15.90	61.02	- 0.36
reach001	2340	18.00	101.71	102.36		102.38	0.000697	1.17	16.15	61.42	0.36
reach001	2320	25.30	101.70	102.24		102.33	0.005012	2.46	10.38	48.87	0.90
reach001	2300	25.30	101.60	102.14		102.23	0.004971	2.45	10.41	48.93	0.89
reach001	2280	25.30	101.50	102.04		102.13	0.005082	2.46	10.34	48.78	0.90
reach001	2260	25.30	101.40	101.94		102.03	0.004856	2.43	10.49	49.13	0.88
reach001	2240	25.30	101.30	101.84	101.82	101.93	0.005302	2.50	10.19	48.41	0.92
reach001	2220	25.30	101.20	101.77		101.84	0.003376	2.18	11.83	52.30	0.75
reach001	2200	25.30	101.10	101.75		101.79	0.001254	1.60	16.70	62.48	0.48
reach001	2180	25.30	101.07	101.73		101.77	0.001180	1.57	17.02	62.31	0.47
reach001	2160	25.30	101.05	101.71		101.74	0.001233	1.59	16.81	62.68	0.47
reach001	2140	25.30	101.03	101.68		101.72	0.001318	1.63	16.41	61.92	0.49
reach001	2120	25.30	101.00	101.65		101.69	0.001250	1.60	16.72	62.52	0.48
reach001	2100	25.30	100.97	101.63		101.67	0.001259	1.60	16.69	62.11	0.48
reach001	2080	25.30	100.95	101.60		101.64	0.001262	1.60	16.67	62.41	0.48
reach001	2060	25.30	100.92	101.58		101.62	0.001259	1.60	16.73	62.93	0.48
reach001	2040	25.30	100.90	101.55		101.59	0.001276	1.61	16.60	62.29	0.48
reach001	2020	25.30	100.88	101.53		101.57	0.001298	1.62	16.44	61.59	0.49
reach001	2000	25.30	100.85	101.50		101.54	0.001310	1.62	16.44	61.98	0.49
reach001	1980	25.30	100.82	101.47		101.51	0.001336	1.63	16.33	61.42	0.49
reach001	1960	25.30	100.80	101.45		101.49	0.001378	1.65	16.15	61.41	0.50
reach001	1940	25.30	100.77	101.42		101.46	0.001426	1.67	16.00	61.53	0.51
reach001	1920	25.30	100.75	101.38		101.43	0.001548	1.71	15.49	60.12	0.53
reach001	1900	25.30	100.72	101.34		101.40	0.001906	1.82	14.46	58.27	0.58
reach001	1880	25.30	100.70	101.25		101.34	0.004586	2.39	10.68	49.61	0.86
reach001	1860	25.30	100.61	101.17		101.25	0.003820	2.26	11.35	51.19	0.79

HEC-RAS Plan: co River: Owens Reach: reach001 (Continued)

Reach	River Stage	Q Total (cfs)	Min Ch.Elev	W.S. Elev	Ch.W.S.	E.G. Elev	E.G. Slope	Vel.Chns	Flow Area	Top Width	Froude Chns
reach001	1840	25.30	100.53	101.08		101.17	0.004586	2.39	10.68	49.61	0.86
reach001	1820	25.30	100.44	101.00		101.08	0.003823	2.26	11.35	51.19	0.79
reach001	1800	25.30	100.36	100.91		101.00	0.004577	2.39	10.69	49.63	0.86
reach001	1780	25.30	100.27	100.83		100.91	0.003944	2.28	11.23	50.91	0.80
reach001	1760	25.30	100.19	100.74		100.83	0.004377	2.36	10.85	50.01	0.84
reach001	1740	25.30	100.10	100.69		100.75	0.002500	1.99	13.10	55.15	0.65
reach001	1720	25.30	100.05	100.64		100.70	0.002500	1.99	13.10	55.15	0.65
reach001	1700	25.30	100.00	100.59		100.65	0.002500	1.99	13.10	55.15	0.65
reach001	1680	25.30	99.95	100.54		100.60	0.002500	1.99	13.10	55.15	0.65
reach001	1660	25.30	99.90	100.49		100.55	0.002500	1.99	13.10	55.15	0.65
reach001	1640	25.30	99.85	100.44		100.50	0.002500	1.99	13.10	55.15	- 0.65
reach001	1620	25.30	99.80	100.39		100.45	0.002500	1.99	13.10	55.15	0.65
reach001	1600	25.30	99.75	100.34		100.40	0.002500	1.99	13.10	55.15	0.65
reach001	1580	25.30	99.70	100.29		100.35	0.002499	1.99	13.10	55.15	0.65
reach001	1560	25.30	99.65	100.24		100.30	0.002497	1.98	13.11	55.16	0.65
reach001	1540	25.30	99.60	100.19		100.25	0.002493	1.98	13.12	55.18	0.65
reach001	1520	25.30	99.55	100.14		100.20	0.002482	1.98	13.14	55.22	0.65
reach001	1500	25.30	99.50	100.05		100.14	0.004498	2.38	10.75	49.78	0.85
reach001	1480	25.30	99.41	99.96		100.05	0.004507	2.38	10.74	49.76	0.85
reach001	1460	25.30	99.32	99.87		99.96	0.004476	2.37	10.77	49.82	0.85
reach001	1440	25.30	99.23	99.78		99.87	0.004585	2.39	10.68	49.61	0.86
reach001	1420	25.30	99.14	99.70		99.78	0.003847	2.27	11.32	51.13	0.80
reach001	1400	25.30	99.06	99.61		99.70	0.004506	2.38	10.74	49.76	0.85
reach001	1380	25.30	98.97	99.52		99.61	0.004476	2.37	10.77	49.82	0.85
reach001	1360	25.30	98.88	99.43		99.52	0.004583	2.39	10.69	49.62	0.86
reach001	1340	25.30	98.79	99.35		99.43	0.003870	2.27	11.30	51.08	0.80
reach001	1320	25.30	98.70	99.32		99.37	0.001880	1.82	14.47	58.04	0.58
reach001	1300	25.30	98.66	99.28		99.33	0.001794	1.79	14.71	58.53	0.56
reach001	1280	25.30	98.62	99.24		99.29	0.001844	1.81	14.58	58.11	0.57
reach001	1260	25.30	98.59	99.21		99.26	0.001918	1.83	14.37	57.83	0.58
reach001	1240	25.30	98.55	99.17		99.22	0.001855	1.81	14.54	58.18	0.57
reach001	1220	25.30	98.51	99.13		99.18	0.001755	1.78	14.82	58.77	0.56
reach001	1200	25.30	98.47	99.09		99.14	0.001959	1.84	14.32	58.00	0.59
reach001	1180	25.30	98.44	99.05		99.11	0.001953	1.84	14.28	57.64	0.59
reach001	1160	25.30	98.40	99.02		99.07	0.001915	1.83	14.38	57.85	0.58
reach001	1140	25.30	98.36	98.98		99.03	0.001850	1.81	14.55	58.21	0.57

HEC-RAS Plan: co River: Owens Reach: reach001 (Continued)

Reach	River Sta.	Q, Total	Min Ch.Elev	W.S./Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel. Chnl	Flow Area	Top Width	Froude # Chnl
reach001	1200	25.30	98.32	98.94		98.99	0.001757	1.78	14.78	58.07	0.56
reach001	1100	25.30	98.29	98.90		98.96	0.001934	1.83	14.33	57.74	0.58
reach001	1080	25.30	98.25	98.87		98.92	0.001882	1.82	14.46	58.03	0.58
reach001	1060	25.30	98.21	98.83		98.88	0.001797	1.79	14.70	58.51	0.56
reach001	1040	25.30	98.17	98.79		98.84	0.001838	1.80	14.60	58.11	0.57
reach001	1020	25.30	98.14	98.76		98.81	0.001918	1.83	14.37	57.83	0.58
reach001	1000	25.30	98.10	98.72		98.77	0.001856	1.81	14.53	58.17	0.57
reach001	980	25.30	98.06	98.68		98.73	0.001756	1.78	14.82	58.76	0.56
reach001	960	25.30	98.02	98.65		98.70	0.001610	1.73	15.28	59.69	0.54
reach001	940	25.30	97.99	98.62		98.66	0.001672	1.75	15.08	59.28	0.55
reach001	920	25.30	97.95	98.59		98.63	0.001487	1.69	15.72	60.56	0.52
reach001	900	25.30	97.91	98.56		98.60	0.001263	1.60	16.66	62.40	0.48
reach001	880	25.30	97.87	98.54		98.58	0.001026	1.50	17.96	64.84	0.44
reach001	860	25.30	97.84	98.53		98.56	0.000909	1.44	18.76	66.32	0.41
reach001	840	25.30	97.80	98.51		98.54	0.000700	1.33	20.59	67.98	0.37
reach001	820	25.30	97.76	98.50		98.53	0.000529	1.21	22.67	67.98	0.32
reach001	800	25.30	97.72	98.50		98.51	0.000397	1.10	24.95	67.98	0.28
reach001	780	25.30	97.69	98.49		98.51	0.000328	1.04	26.58	67.98	0.26
reach001	760	25.30	97.65	98.49		98.50	0.000250	0.95	29.04	67.98	0.23
reach001	740	25.30	97.61	98.48		98.50	0.000193	0.87	31.55	67.98	0.20
reach001	720	25.30	97.57	98.48		98.49	0.000151	0.80	34.12	67.98	0.18
reach001	700	25.30	97.54	98.48		98.49	0.000127	0.76	36.01	67.98	0.17
reach001	680	25.30	97.50	98.48		98.49	0.000102	0.71	38.62	67.98	0.15
reach001	660	25.30	97.46	98.48		98.48	0.000082	0.66	41.26	67.98	0.14
reach001	640	25.30	97.42	98.48		98.48	0.000067	0.62	43.92	67.98	0.13
reach001	620	25.30	97.39	98.48		98.48	0.000059	0.59	45.89	67.98	0.12
reach001	600	25.30	97.35	98.47		98.48	0.000049	0.56	48.56	67.98	0.11
reach001	580	25.30	97.31	98.47		98.48	0.000041	0.53	51.24	67.98	0.10
reach001	560	25.30	97.27	98.47		98.48	0.000035	0.50	53.93	67.98	0.09
reach001	540	25.30	97.24	98.47		98.48	0.000031	0.48	55.93	67.98	0.09
reach001	520	25.30	97.20	98.47		98.48	0.000027	0.46	58.63	67.99	0.08
reach001	500	25.30	97.16	98.47		98.48	0.000023	0.44	61.32	67.99	0.08
reach001	480	25.30	97.12	98.47		98.47	0.000020	0.42	64.03	67.99	0.07
reach001	460	25.30	97.09	98.47		98.47	0.000018	0.41	66.05	67.99	0.07
reach001	440	25.30	97.05	98.47		98.47	0.000016	0.39	68.75	67.99	0.07
reach001	420	25.30	97.01	98.47		98.47	0.000014	0.38	71.46	67.99	0.06

HEC-RAS Plan: co River: Owens Reach: reach001 (Continued)

Reach ID	River Stage	Q (ft³/s)	Min Ch.Elev.	W.S. Elev.	Crit W.S.	E.G. Elev.	E.G. Slope	Vel.Chn.	Flow Area	Top Width	Froude # (Ch.)
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/m)	(ft/s)	(sq ft)	(ft)	
reach001_001	400	25.30	96.97	98.47		98.47	0.000012	0.36	74.17	67.99	0.06
reach001_002	380	25.30	96.94	98.47		98.47	0.000011	0.35	76.19	67.99	0.06
reach001_003	360	25.30	96.90	98.47		98.47	0.000010	0.34	78.90	67.99	0.05
reach001_004	340	25.30	96.86	98.47		98.47	0.000009	0.33	81.62	67.99	0.05
reach001_005	320	25.30	96.82	98.47		98.47	0.000008	0.32	84.33	67.99	0.05
reach001_006	300	25.30	96.79	98.47		98.47	0.000007	0.31	86.36	67.99	0.05
reach001_007	280	25.30	96.75	98.47		98.47	0.000007	0.30	89.07	67.99	0.04
reach001_008	260	25.30	96.71	98.47		98.47	0.000006	0.29	91.79	67.99	0.04
reach001_009	240	25.30	96.67	98.47		98.47	0.000006	0.28	94.50	67.99	0.04
reach001_010	220	25.30	96.64	98.47		98.47	0.000005	0.28	96.54	67.99	0.04
reach001_011	200	25.30	96.60	98.47		98.47	0.000005	0.27	99.25	67.99	- 0.04
reach001_012	180	25.30	96.56	98.47		98.47	0.000004	0.26	101.97	67.99	0.04
reach001_013	160	25.30	96.52	98.47		98.47	0.000004	0.25	104.69	67.99	0.04
reach001_014	140	25.30	96.49	98.47		98.47	0.000004	0.25	108.72	67.99	0.03
reach001_015	120	25.30	96.45	98.47		98.47	0.000003	0.24	109.44	67.99	0.03
reach001_016	100	25.30	96.41	98.47	96.93	98.47	0.000003	0.24	112.16	67.99	0.03

SUPPLEMENTAL
HYDROLOGY AND HYDRAULIC
CALCULATIONS

for the
MISSION BAY PROJECT

Including

Water Surface Profile on Overland Release Route
Basin 1 – Third St./North-South Common St./Terry François Blvd.
(Initial and Final Conditions 12/01/00)

and

Weir Analysis at Overland Release Point
Basin 1 – Terry François Blvd. Release Point
(Initial and Final Conditions 12/01/00)

Weir Analysis at Overland Release Point
Basin 5 – Round About Release Point
(Initial Conditions 4/26/00)

Prepared for :



CATELLUS

DECEMBER 1, 2000



6

Water Surface Profile on Overland Release Route

Basin 1 – Third St/North-South Common St/Terry François Blvd

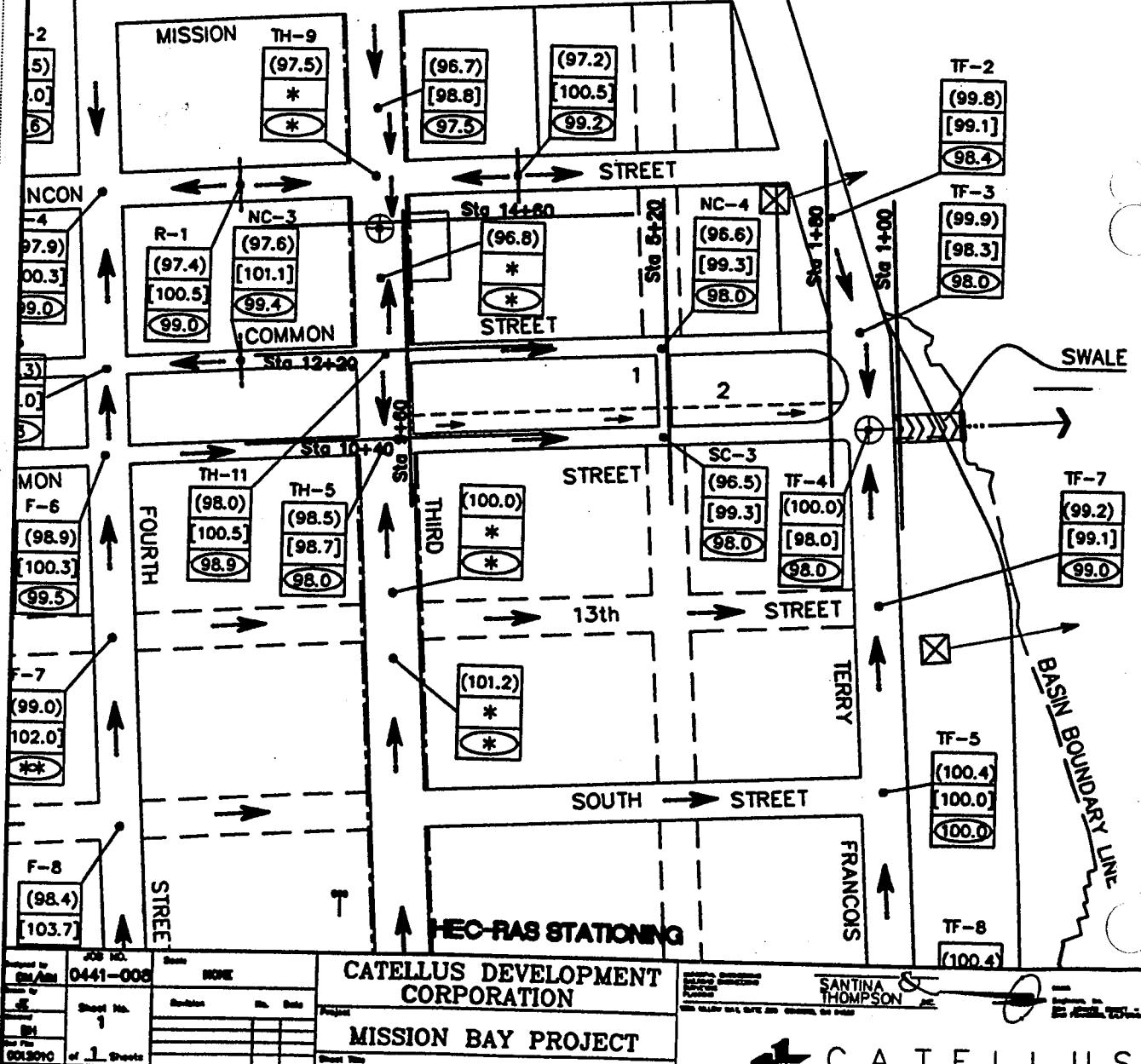
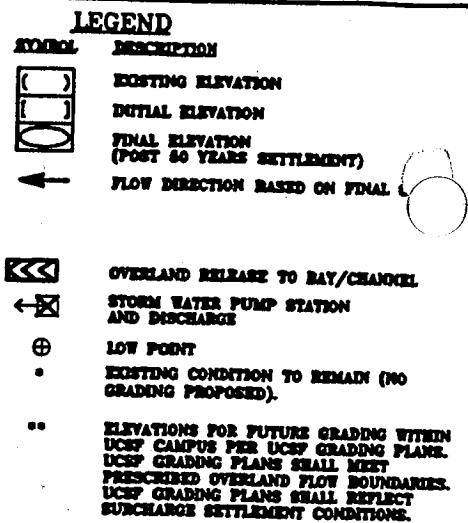
(Initial and Final Conditions, 12/01/00)

The following HEC-RAS analysis was performed on the curb profiles described on the attached Conceptual Grading Plan dated 12/01/00. The HEC-RAS analysis was performed twice, once for the initial grades and once for the final grades, fifty years hence. The respective weir water surface elevations of 98.3 feet and 98.2 feet were used as the starting water level. The weir analysis follows later in this study. A Manning coefficient of .016 was used for the streets and sidewalk and a coefficient of .03 was used for the Commons park area. The sheets of the two HEC-RAS analyses are organized as follows:

- Sheet 1: Plan view with the HEC-RAS stationing shown, used for both initial and final grades
- Sheet 2: Initial Water Surface Profile as calculated by HEC-RAS.
- Sheet 3: Initial Street Cross Section at HEC-RAS station 100.
- Sheet 4: Initial Street Cross Section at HEC-RAS station 180.
- Sheet 5: Initial Street Cross Section at HEC-RAS station 520.
- Sheet 6: Initial Street Cross Section at HEC-RAS station 920.
- Sheet 7: Initial Street Cross Section at HEC-RAS station 960. Note the water surface elevation at 99.07
- Sheet 8: Initial Street Cross Section at HEC-RAS station 1000. This station was used to model the transition between North and South Common and 3rd Street.
- Sheet 9: Initial Street Cross Section at HEC-RAS station 1040
- Sheet 10: Initial Street Cross Section at HEC-RAS station 1220
- Sheet 11 & 12: Tabular information regarding the water surface profile for Initial Conditions
- Sheet 13: Final Water Surface Profile as calculated by HEC-RAS.
- Sheet 14: Final Street Cross Section at HEC-RAS station 100.
- Sheet 15: Final Street Cross Section at HEC-RAS station 180.
- Sheet 16: Final Street Cross Section at HEC-RAS station 520.
- Sheet 17: Final Street Cross Section at HEC-RAS station 920.
- Sheet 18: Final Street Cross Section at HEC-RAS station 960. Note the water surface elevation at 998.35
- Sheet 19: Final Street Cross Section at HEC-RAS station 1000. This station was used to model the transition between North and South Common and 3rd Street.
- 8

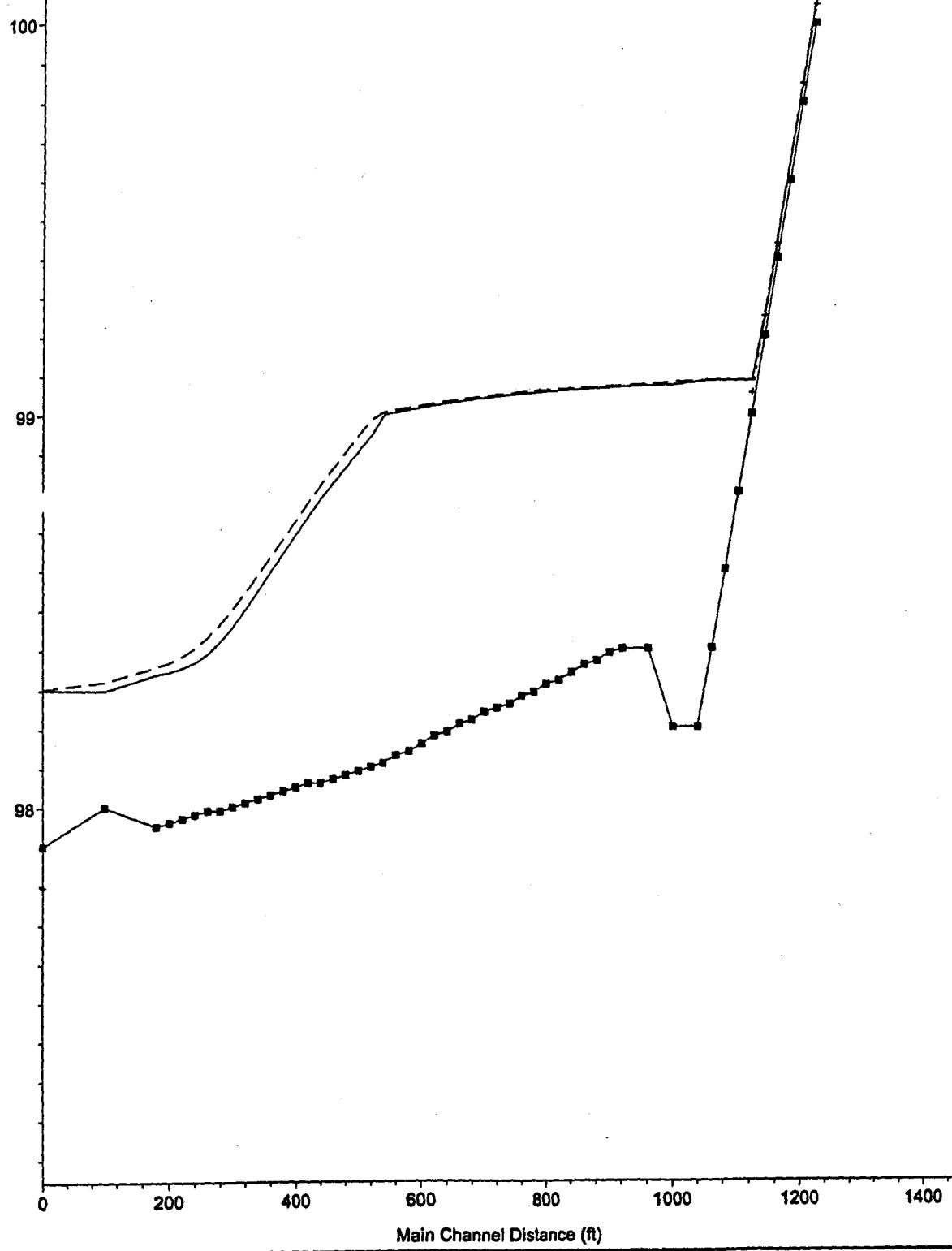
- Sheet 20: Final Street Cross Section at HEC-RAS station 1040
Sheet 21: Final Street Cross Section at HEC-RAS station 1220
Sheet 22 & 23: Tabular information regarding the water surface profile for
Final Conditions

Note that the Q's used for each cross section are presented on the above sheets. Q's were established in the December 1, 2000 Overland Flow Analysis presented earlier in this Drainage Study. Note also on sheets 11 & 12 and 22 & 23, the stations indicated with an asterisk are stations where the geometric data were interpolated. The water properties at these stations; however, were calculated by the HEC-RAS program.



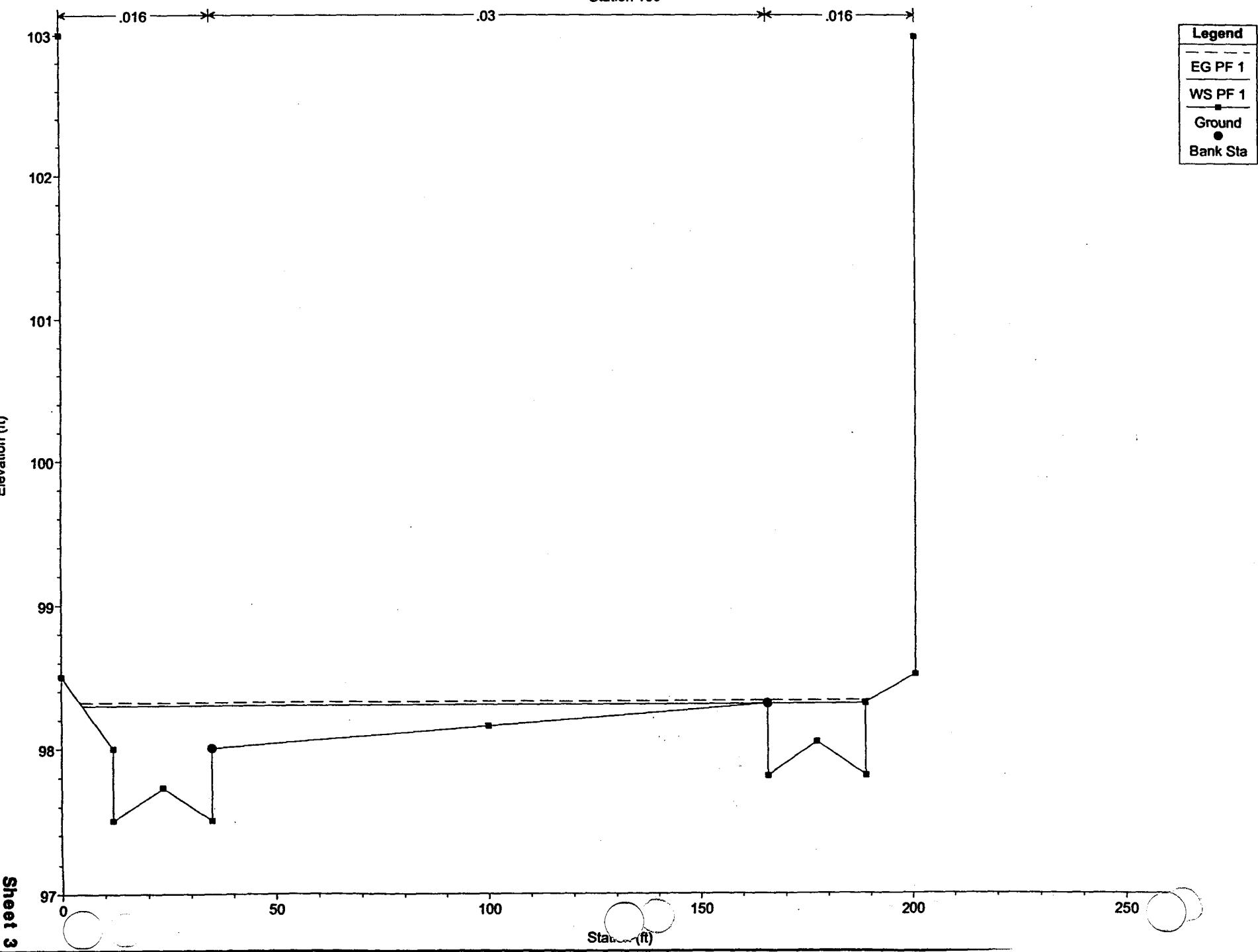
C A T F I I I C

Legend
EG PF 1
WS PF 1
Crit PF 1
Ground



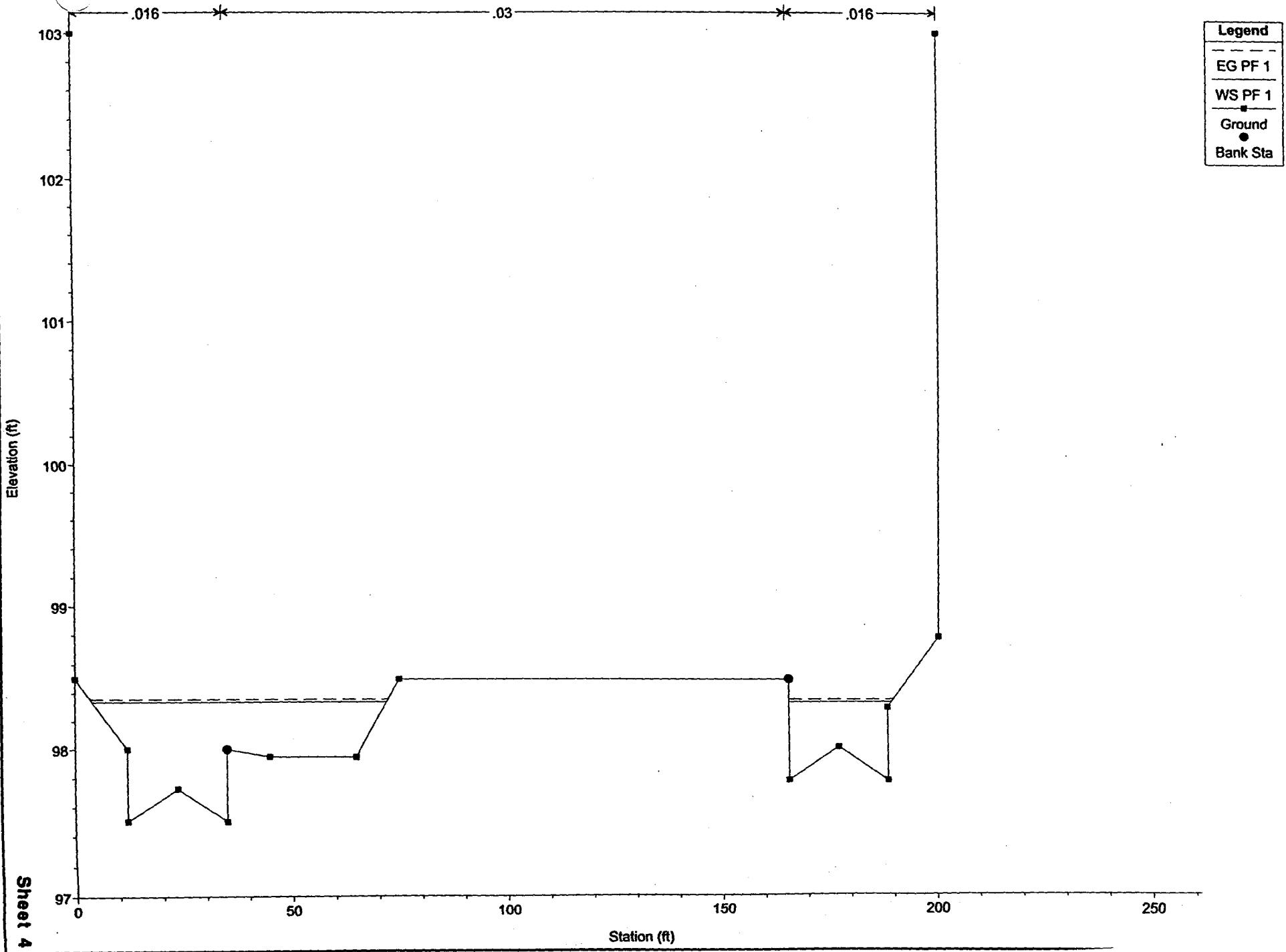
Catellus Common 3rd init 12/01/00 12/01/00 Plan 11/29/00

Station 100



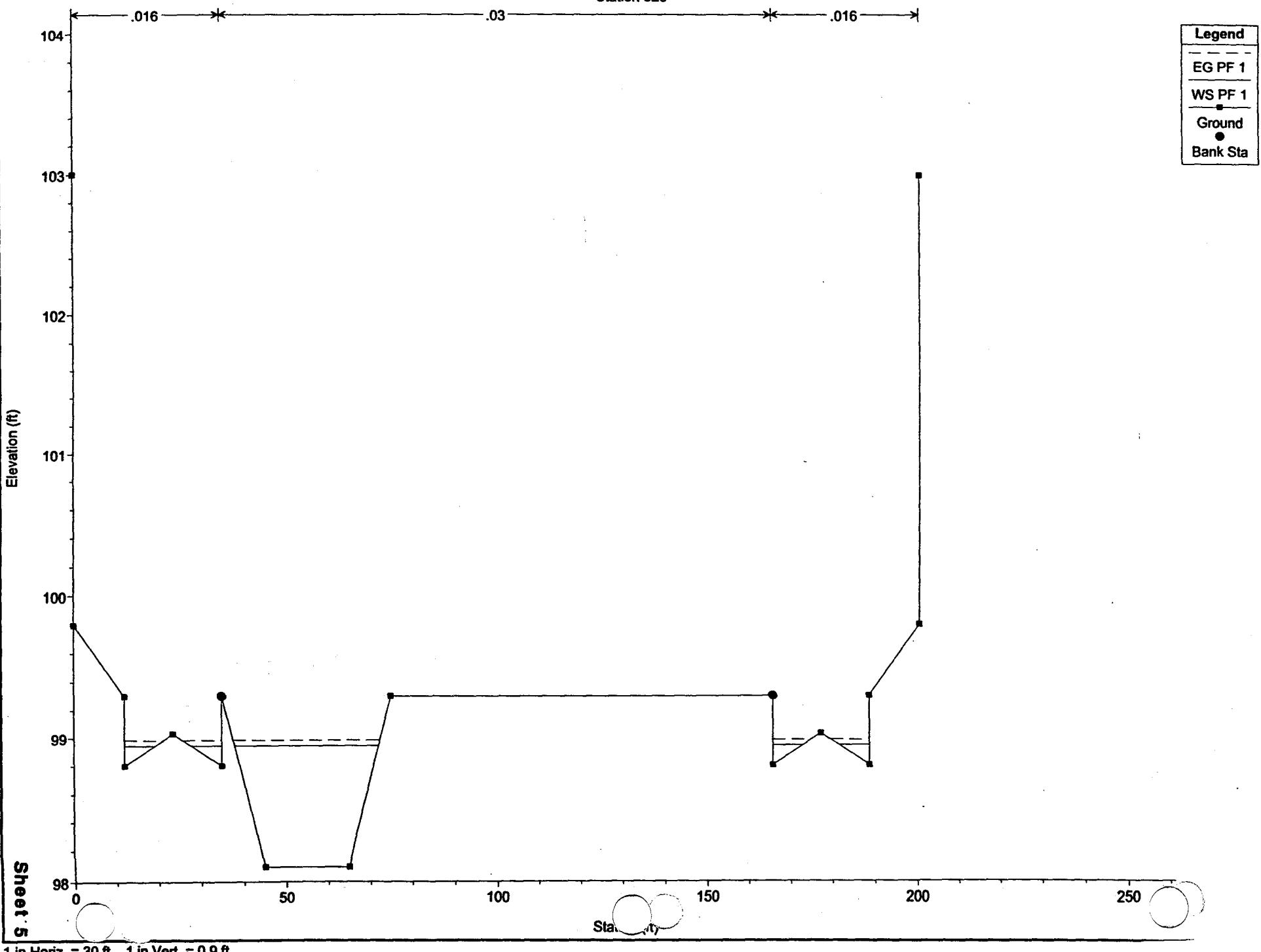
Catellus Common 3rd init 12/01/00 Plan 11/29/00

Station 180



Catellus Common 3rd init 12/01/00 12/01/00 Plan 11/29/00

Station 520



1 in Horiz. = 30 ft 1 in Vert. = 0.9 ft

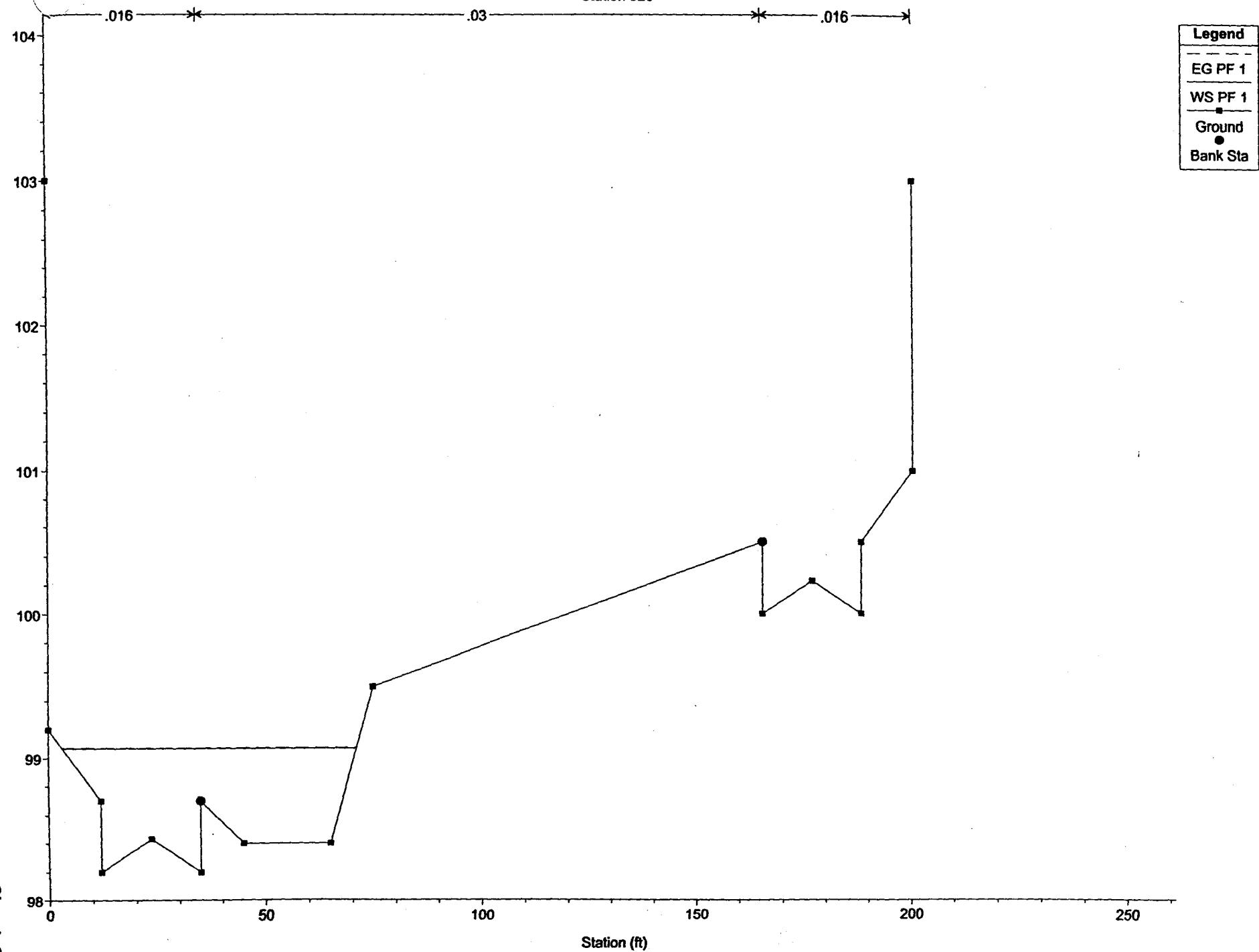
Catellus Common 3rd init

12/01/00 Plan

Station 920

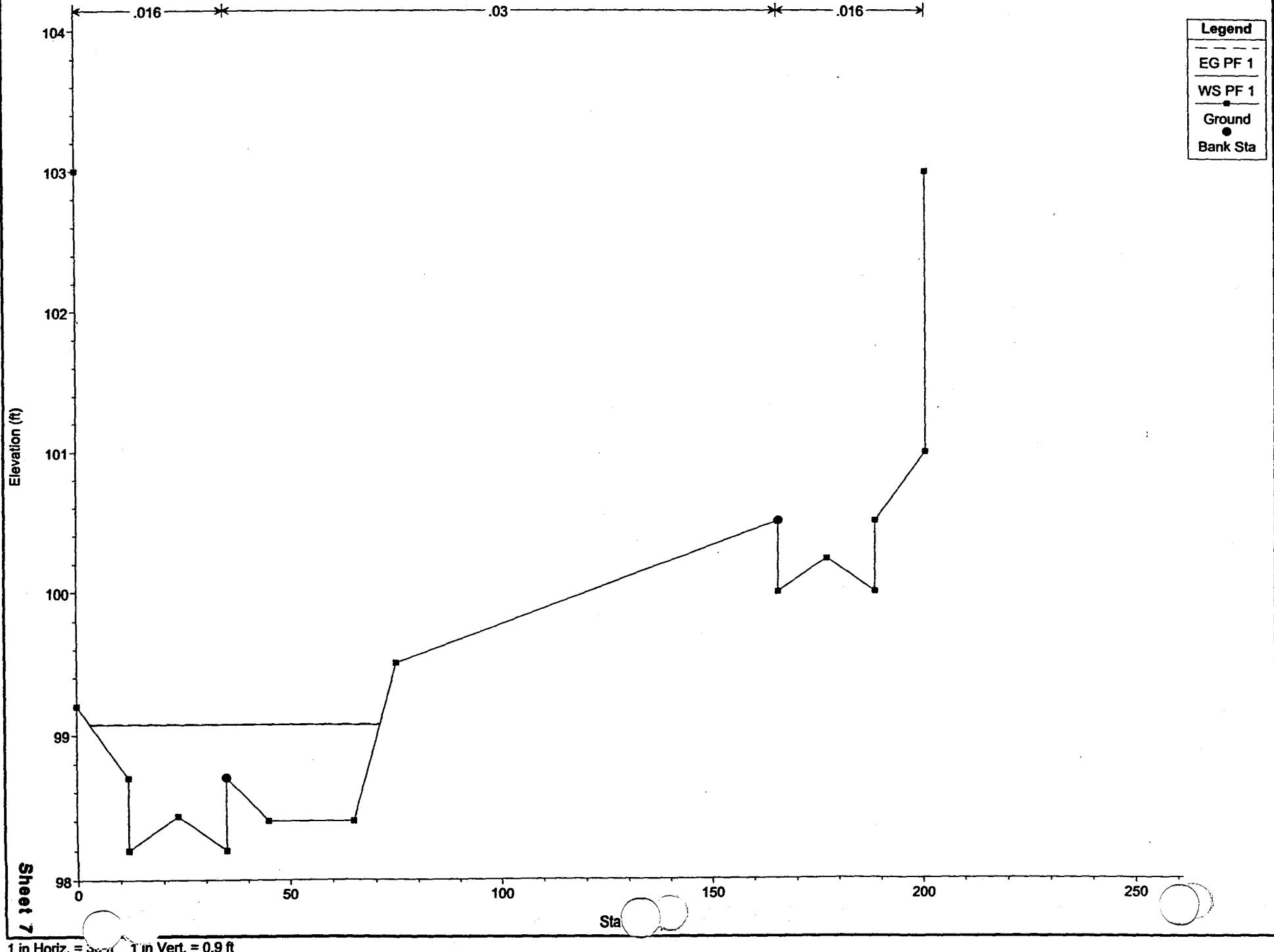
11/29/00

Sheet 6



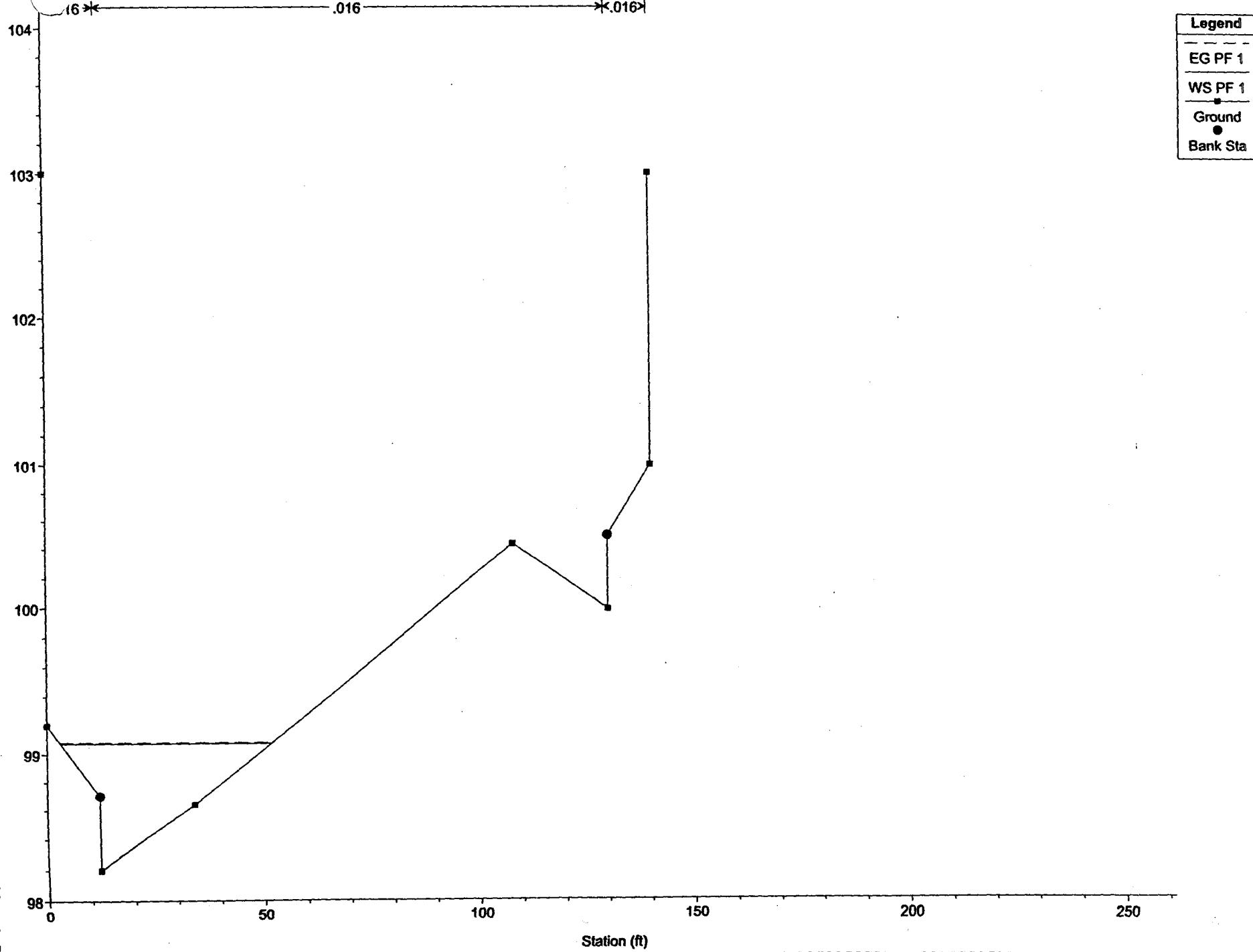
1 in Horiz. = 30 ft 1 in Vert. = 0.9 ft

Catellus Common 3rd init 12/00 12/01/00 Plan 11/29/00
Station 960

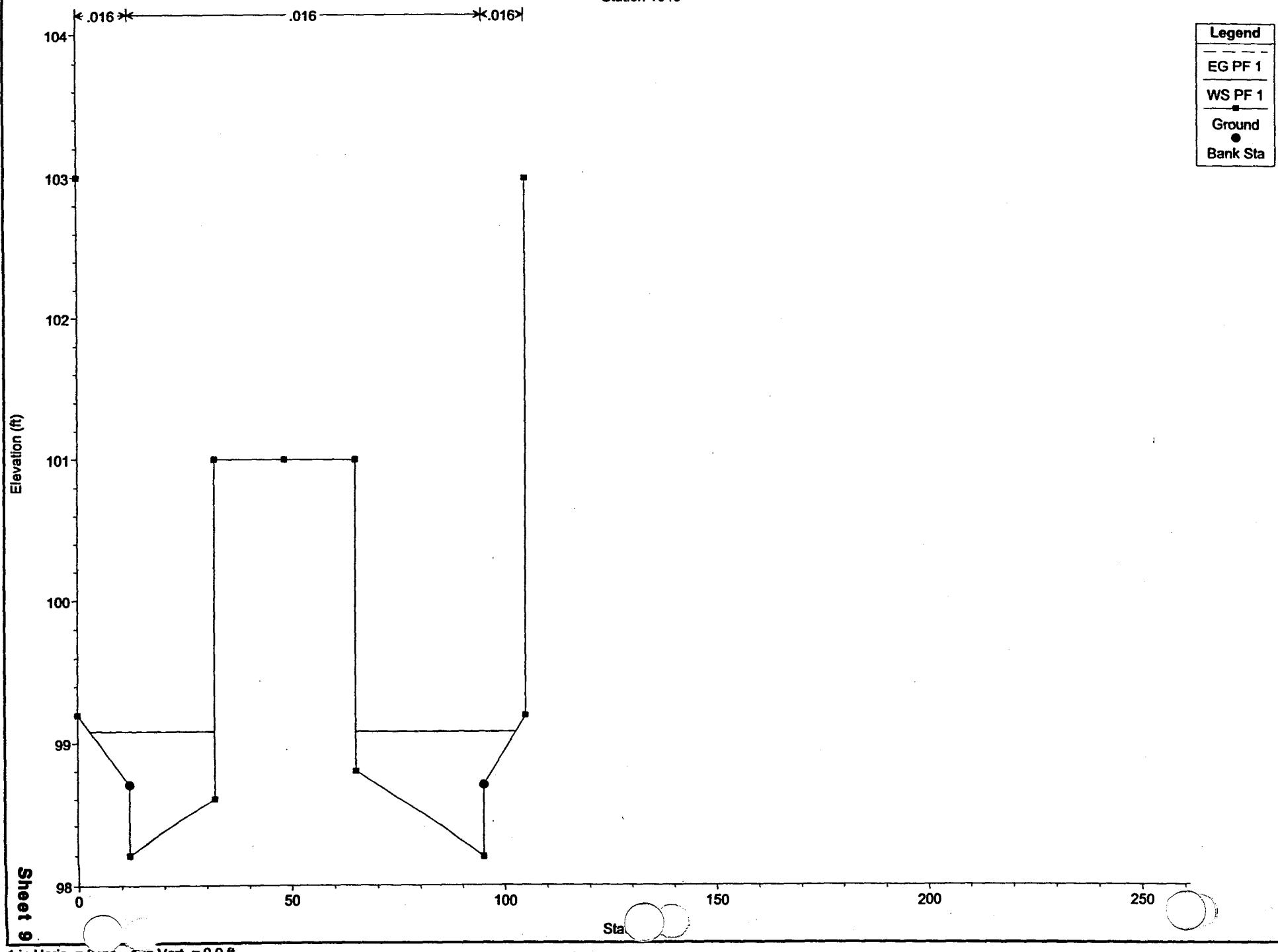


Catellus Common 3rd init 1 12/01/00 Plan 11/29/00

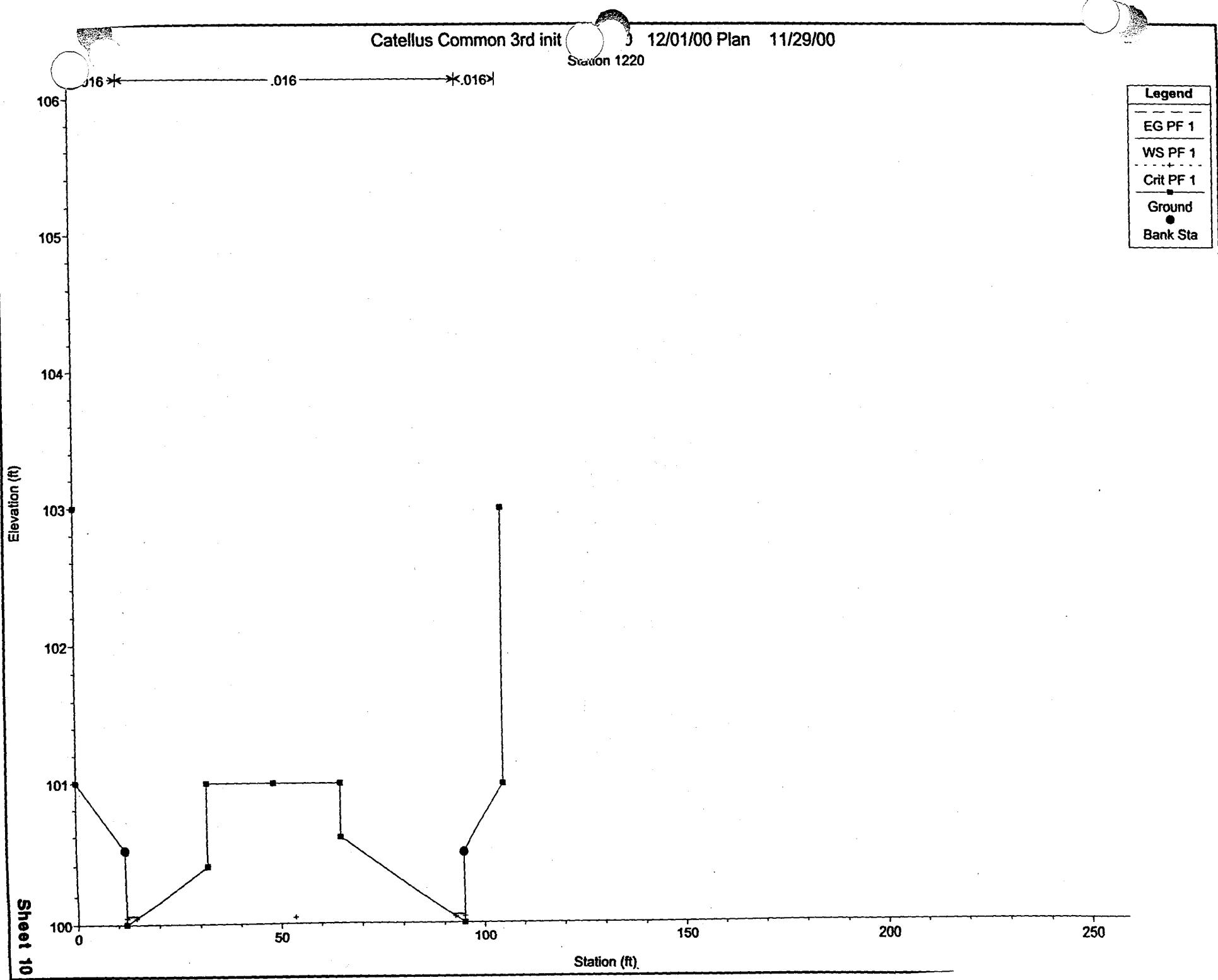
S. 1000



Catellus Common 3rd init 12/01/00 12/01/00 Plan 11/29/00
Station 1040



Station 1220



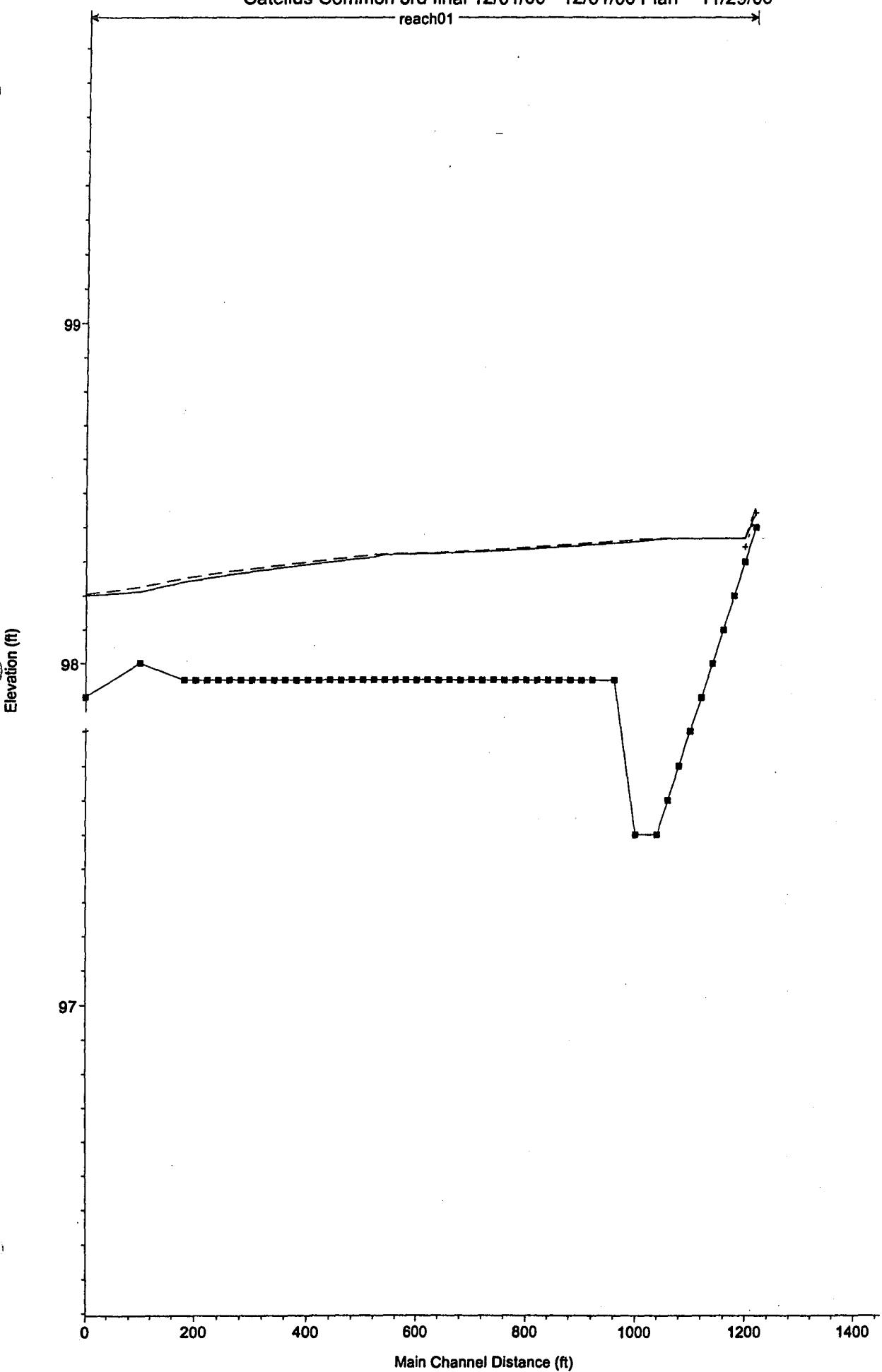
HEC-RAS Plat 00 River: 3rd Common Reach: reach01

Reach #	River Sta#	Q Total (cfs)	Min Ch El. (ft)	W.S. Elev. (ft)	Crit W.S. (ft)	E.G. Elev. (ft)	E.G. Slope (ft/ft)	Vel Chnl. (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl.
reach01	1220	0.10	100.00	100.06	100.05	100.07	0.003484	0.53	0.19	6.14	0.53
reach01	1200	0.10	99.80	99.85	99.85	99.86	0.014587	0.91	0.11	4.69	1.04
reach01	1180	0.10	99.60	99.65		99.66	0.009101	0.76	0.13	5.13	0.84
reach01	1160	0.10	99.40	99.45	99.44	99.46	0.011925	0.84	0.12	4.88	0.95
reach01	1140	0.10	99.20	99.25	99.25	99.26	0.009914	0.79	0.13	5.05	0.87
reach01	1120	0.10	99.00	99.08	99.05	99.09	0.000620	0.28	0.36	8.49	0.24
reach01	1100	0.10	98.80	99.09		99.09	0.000001	0.02	4.08	28.56	0.01
reach01	1080	0.10	98.60	99.09		99.09	0.000000	0.01	11.61	44.28	0.00
reach01	1060	0.10	98.40	99.09		99.09	0.000000	0.00	22.04	58.16	0.00
reach01	1040	13.60	98.20	99.08		99.09	0.000040	0.42	34.34	66.81	0.09
reach01	1000	13.60	98.20	99.07		99.08	0.000167	0.71	19.94	48.82	0.18
reach01	960	17.30	98.40	99.07		99.08	0.000079	0.30	39.82	68.05	0.07
reach01	920	17.30	98.40	99.07		99.07	0.000081	0.31	39.60	67.94	0.07
reach01	900	17.30	98.39	99.07		99.07	0.000088	0.32	38.70	67.25	0.07
reach01	880	17.30	98.37	99.07		99.07	0.000095	0.34	38.11	66.60	0.08
reach01	860	17.30	98.36	99.06		99.07	0.000103	0.35	37.24	65.90	0.08
reach01	840	17.30	98.34	99.06		99.07	0.000111	0.37	36.68	65.24	0.08
reach01	820	17.30	98.32	99.06		99.06	0.000118	0.38	36.14	64.56	0.09
reach01	800	17.30	98.31	99.06		99.06	0.000129	0.40	35.30	63.84	0.09
reach01	780	17.30	98.29	99.05		99.06	0.000138	0.42	34.79	63.15	0.09
reach01	760	17.30	98.28	99.05		99.06	0.000150	0.44	33.98	62.42	0.10
reach01	740	17.30	98.26	99.05		99.05	0.000159	0.45	33.49	61.71	0.10
reach01	720	17.30	98.25	99.04		99.05	0.000174	0.47	32.70	60.96	0.11
reach01	700	17.30	98.24	99.04		99.05	0.000189	0.49	31.93	60.20	0.11
reach01	680	17.30	98.22	99.04		99.04	0.000200	0.51	31.47	59.75	0.11
reach01	660	17.30	98.21	99.03		99.04	0.000218	0.54	30.71	59.42	0.12
reach01	640	17.30	98.19	99.03		99.03	0.000230	0.56	30.23	59.16	0.12
reach01	620	17.30	98.18	99.02		99.03	0.000249	0.59	29.45	58.88	0.13
reach01	600	17.30	98.16	99.02		99.02	0.000260	0.61	28.95	58.66	0.13
reach01	580	17.30	98.14	99.01		99.02	0.000270	0.63	28.49	61.58	0.13
reach01	560	17.30	98.13	99.01		99.01	0.000286	0.65	27.99	66.75	0.14
reach01	540	17.30	98.11	99.00		99.01	0.000285	0.66	28.09	71.93	0.14
reach01	520	39.00	98.10	98.94		98.99	0.001891	1.65	24.90	62.91	0.35
reach01	500	39.00	98.09	98.91		98.95	0.001986	1.65	25.26	69.50	0.36
reach01	480	39.00	98.08	98.87		98.91	0.002108	1.65	25.38	74.44	0.37
reach01	460	39.00	98.07	98.82		98.86	0.002145	1.62	25.88	77.96	0.37
reach01	440	39.00	98.06	98.78		98.82	0.002123	1.57	26.42	80.07	0.37
reach01	420	39.00	98.06	98.74		98.77	0.002334	1.57	25.80	80.47	0.38
reach01	400	39.00	98.05	98.69		98.73	0.002327	1.51	25.92	80.73	0.38
reach01	380	39.00	98.04	98.65		98.68	0.002280	1.44	26.05	80.91	0.37
reach01	360	39.00	98.03	98.60		98.64	0.002321	1.39	25.80	80.96	0.37
reach01	340	39.00	98.02	98.55		98.59	0.002245	1.31	25.79	81.11	0.36
reach01	320	39.00	98.01	98.50		98.55	0.002228	1.24	25.57	81.25	0.35

HEC-RAS Proj: 100 River: 3rd Common Reach: reach01 (Continued)

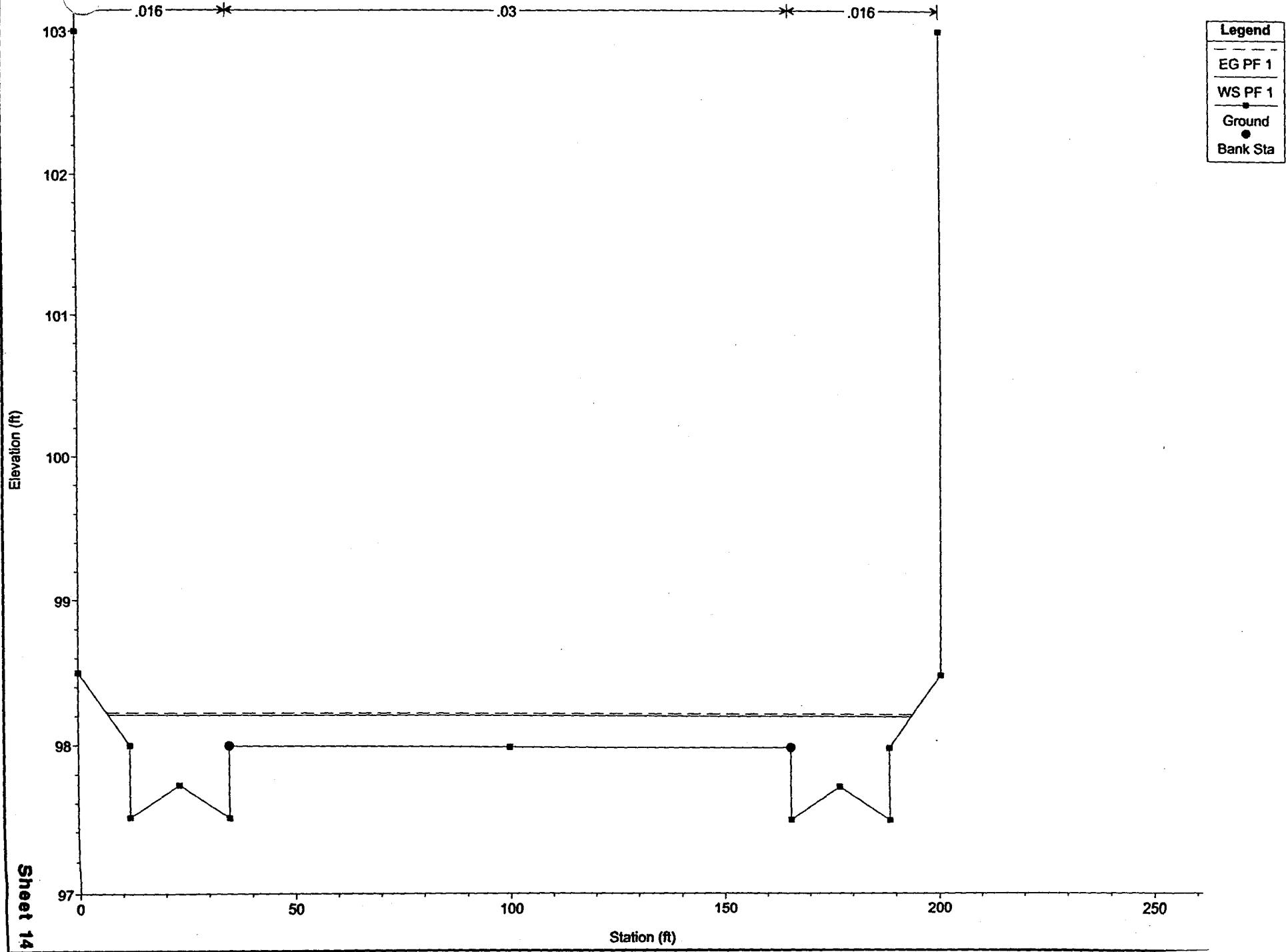
Reach	Fr. Sta.	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
reach01	300.00	39.00	98.00	98.46		98.50	0.002043	1.12	25.83	81.74	0.33
reach01	280.00	39.00	97.99	98.42		98.46	0.001711	1.00	26.90	82.69	0.30
reach01	260.00	39.00	97.99	98.39		98.43	0.001499	0.90	27.60	83.58	0.28
reach01	240.00	39.00	97.98	98.37		98.40	0.001104	0.77	30.04	85.18	0.24
reach01	220.00	39.00	97.97	98.35		98.38	0.000783	0.66	33.19	87.09	0.20
reach01	200.00	39.00	97.96	98.34		98.37	0.000570	0.57	36.45	88.86	0.17
reach01	180.00	39.00	97.95	98.34		98.36	0.000408	0.49	40.51	92.09	0.15
reach01	100.00	39.00	98.00	98.30		98.32	0.000516	0.32	44.83	182.91	0.14
reach01	00.00	39.00	97.90	98.30	97.80	98.30	0.000050	0.36	95.61	200.74	0.10

Legend
EG PF 1
WS PF 1
Crit PF 1
Ground



Catellus Common 3rd final 0 12/01/00 Plan 11/29/00

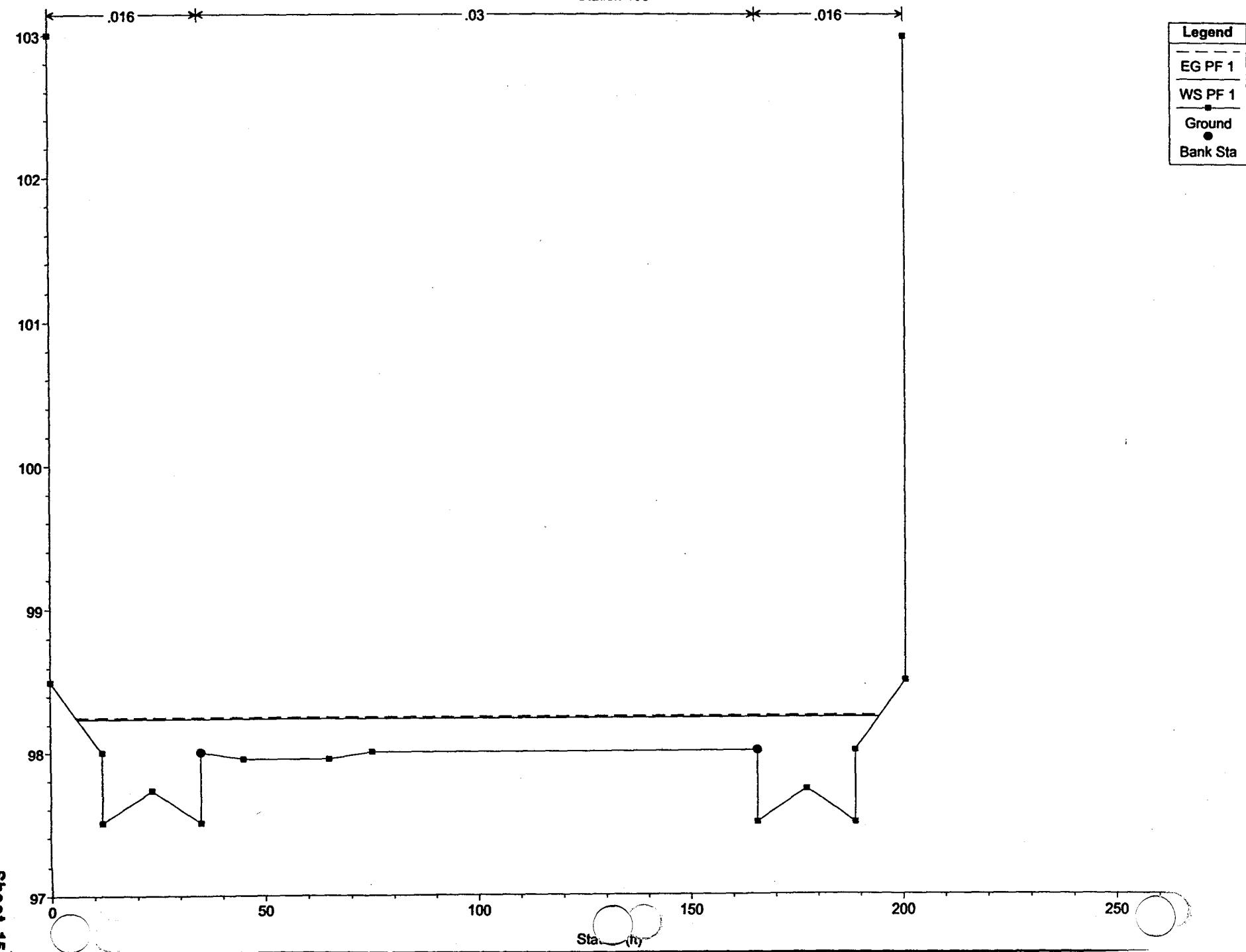
Station 100



1 in Horiz. = 30 ft 1 in Vert. = 0.9 ft

Catellus Common 3rd final 12/0/00 12/01/00 Plan 11/29/00

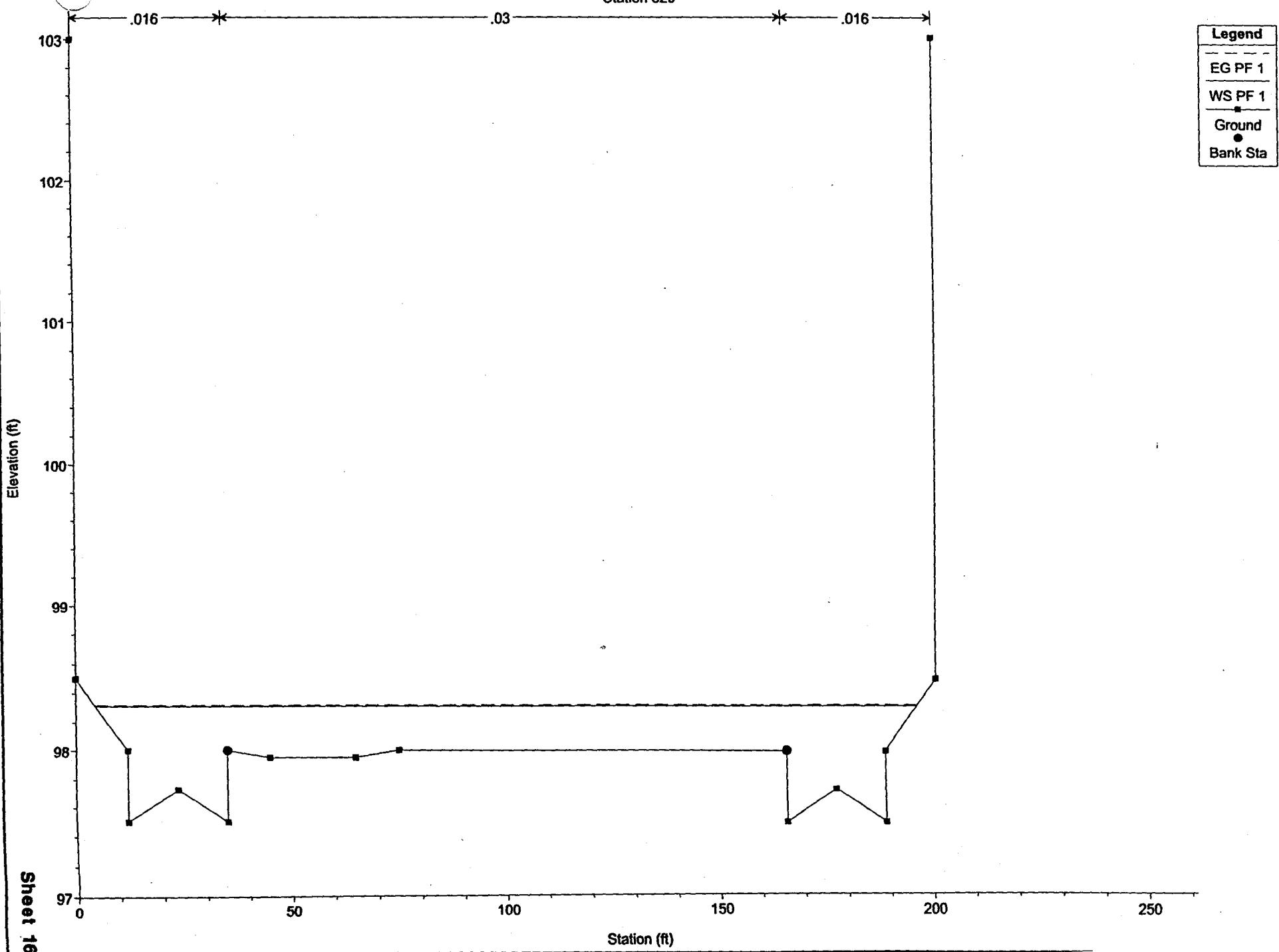
Station 180



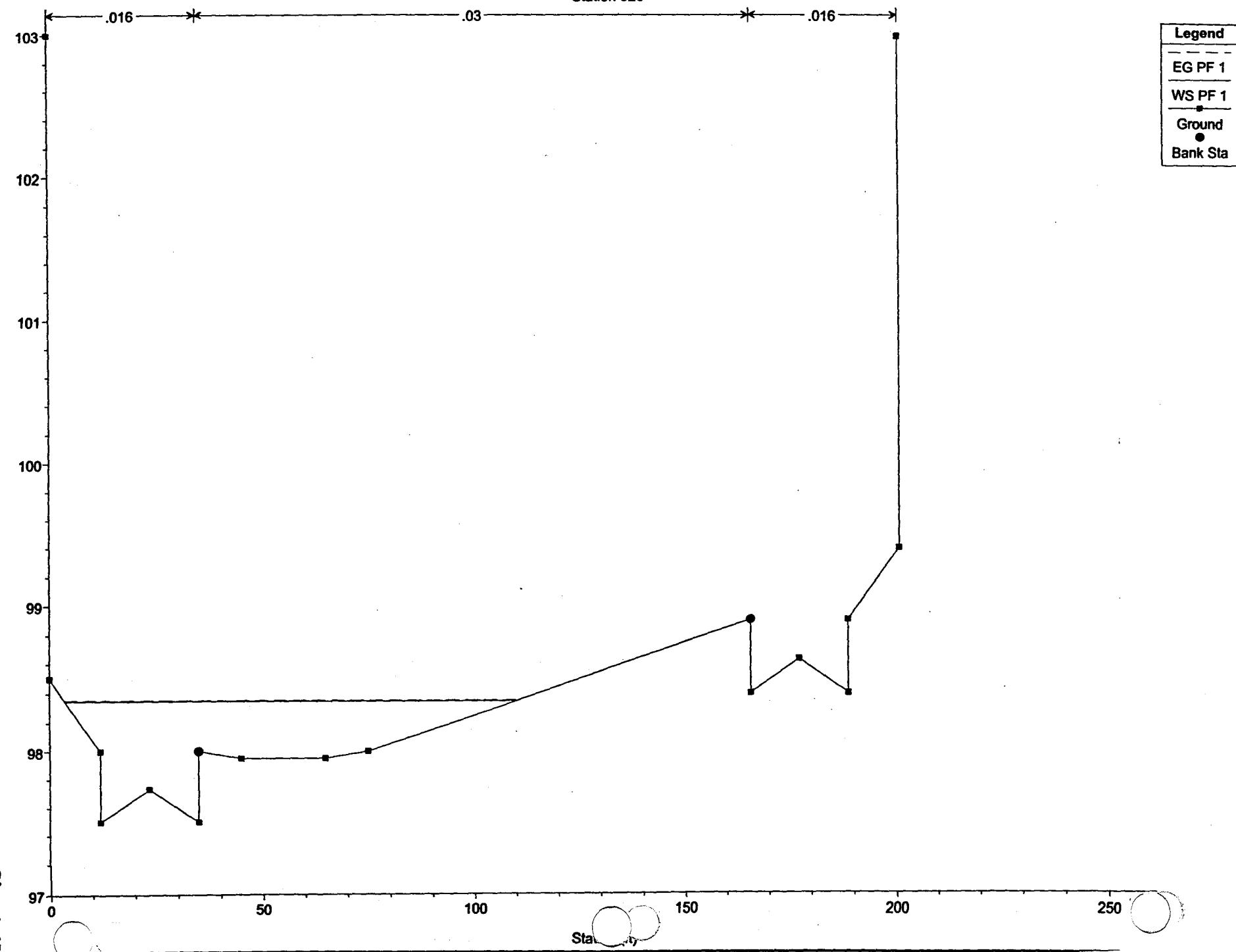
Catellus Common 3rd final

J0 12/01/00 Plan 11/29/00

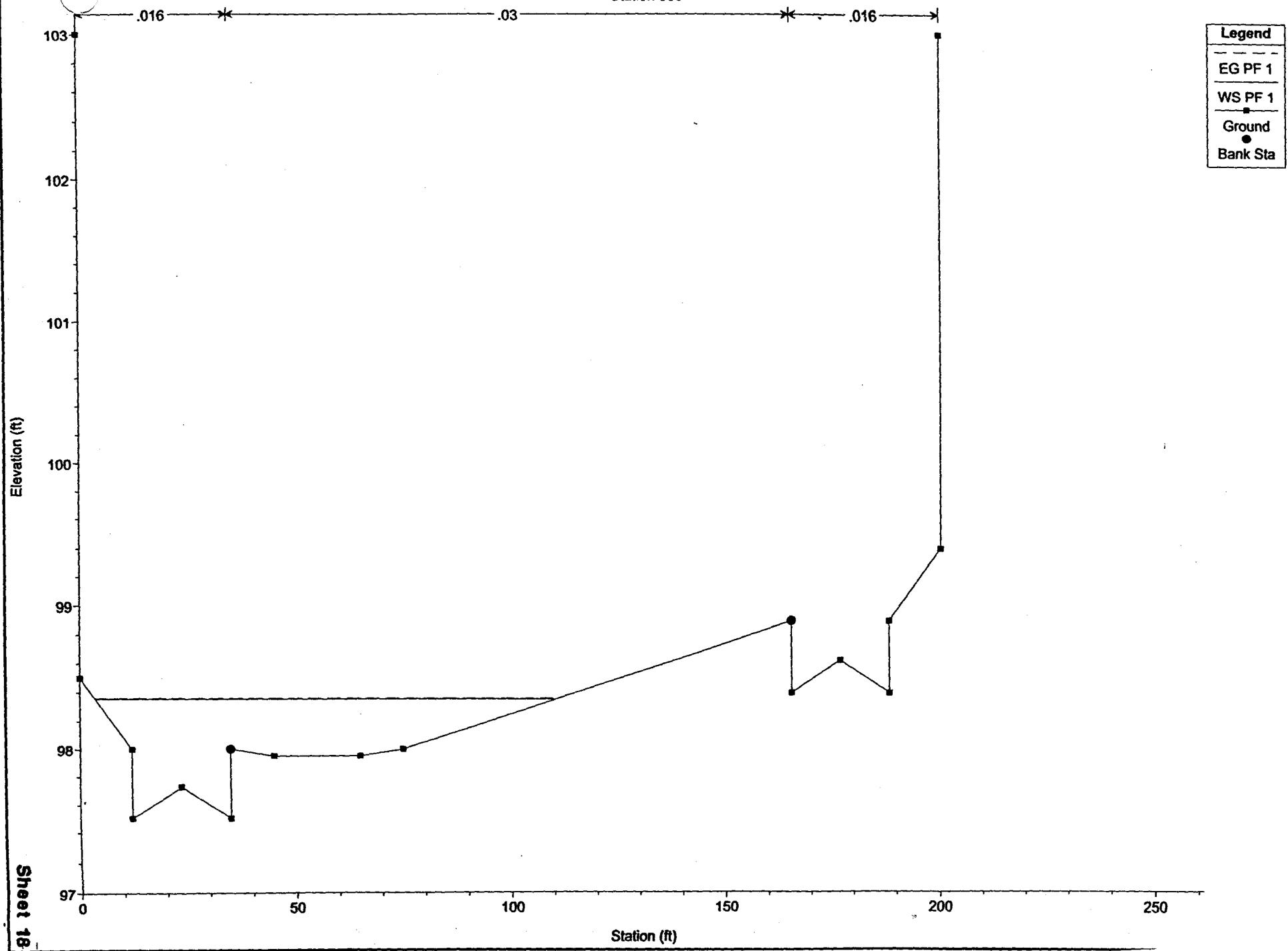
Station 520



Station 920



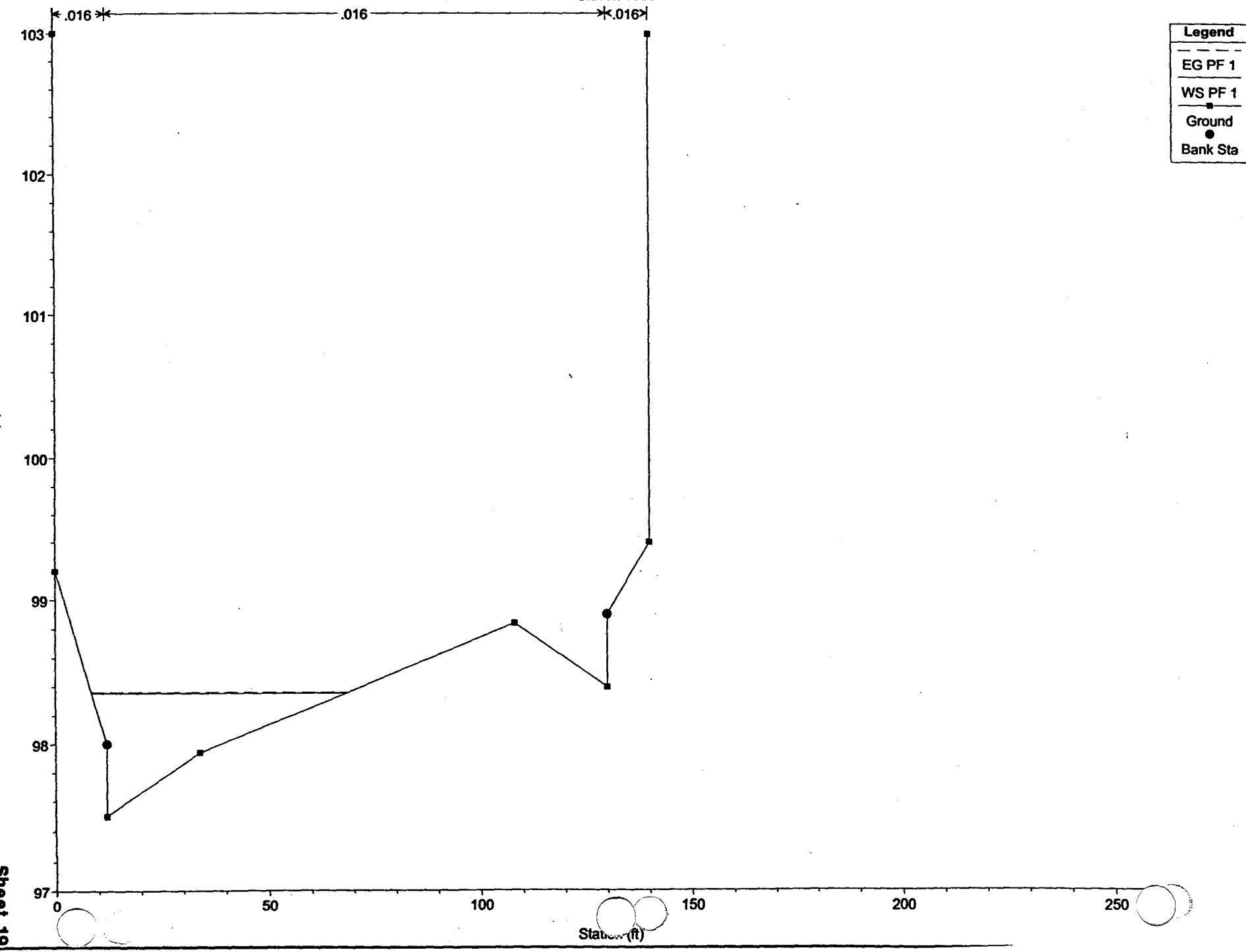
Catellus Common 3rd final 12/01/00 Plan 11/29/00
Station 960



1 in Horiz. = 30 ft 1 in Vert. = 0.9 ft

Catellus Common 3rd final 12/01/00 12/01/00 Plan 11/29/00

Station 1000



Catellus Common 3rd final

J0 12/01/00 Plan 11/29/00

Station 1040

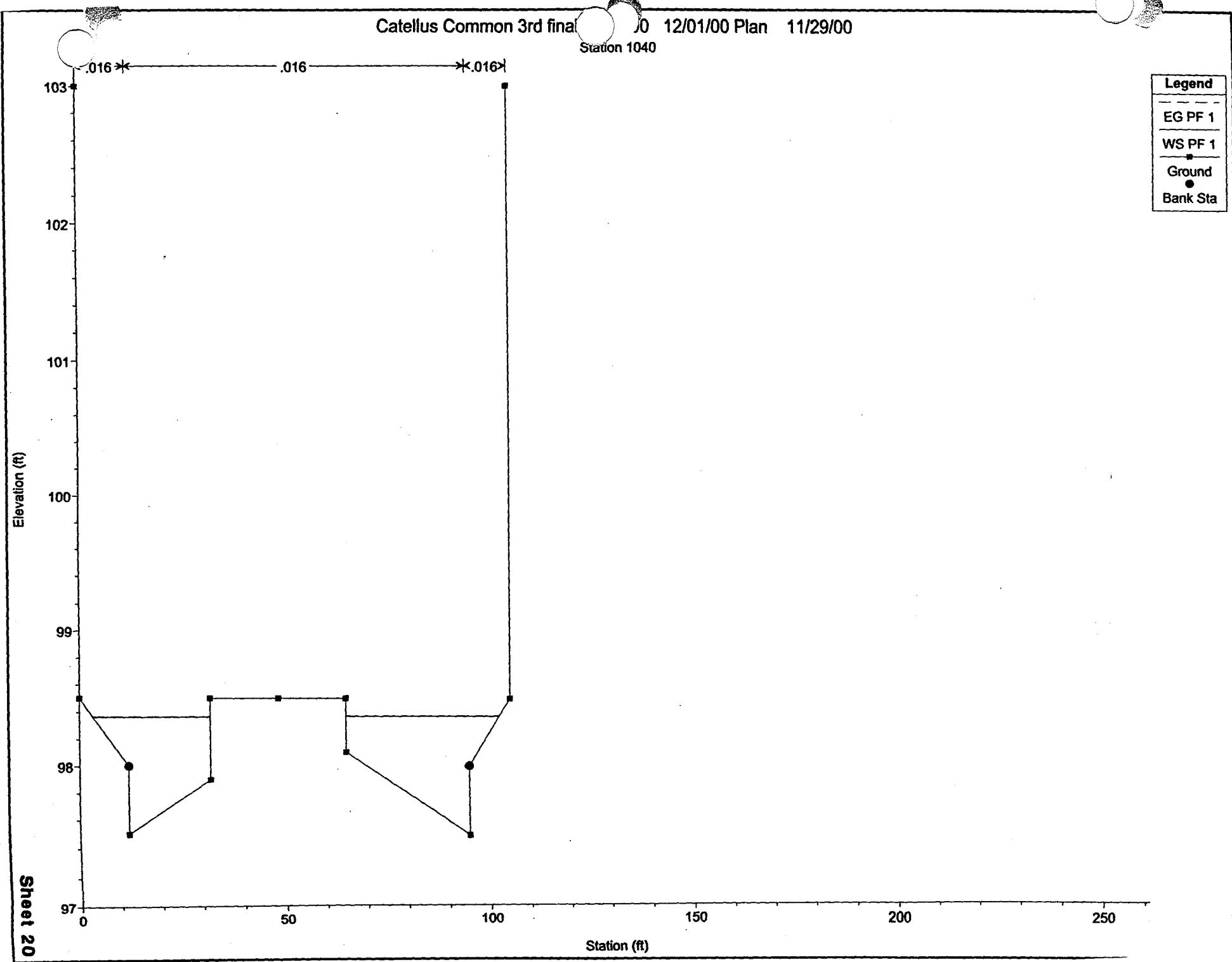
Legend

EG PF 1

WS PF 1

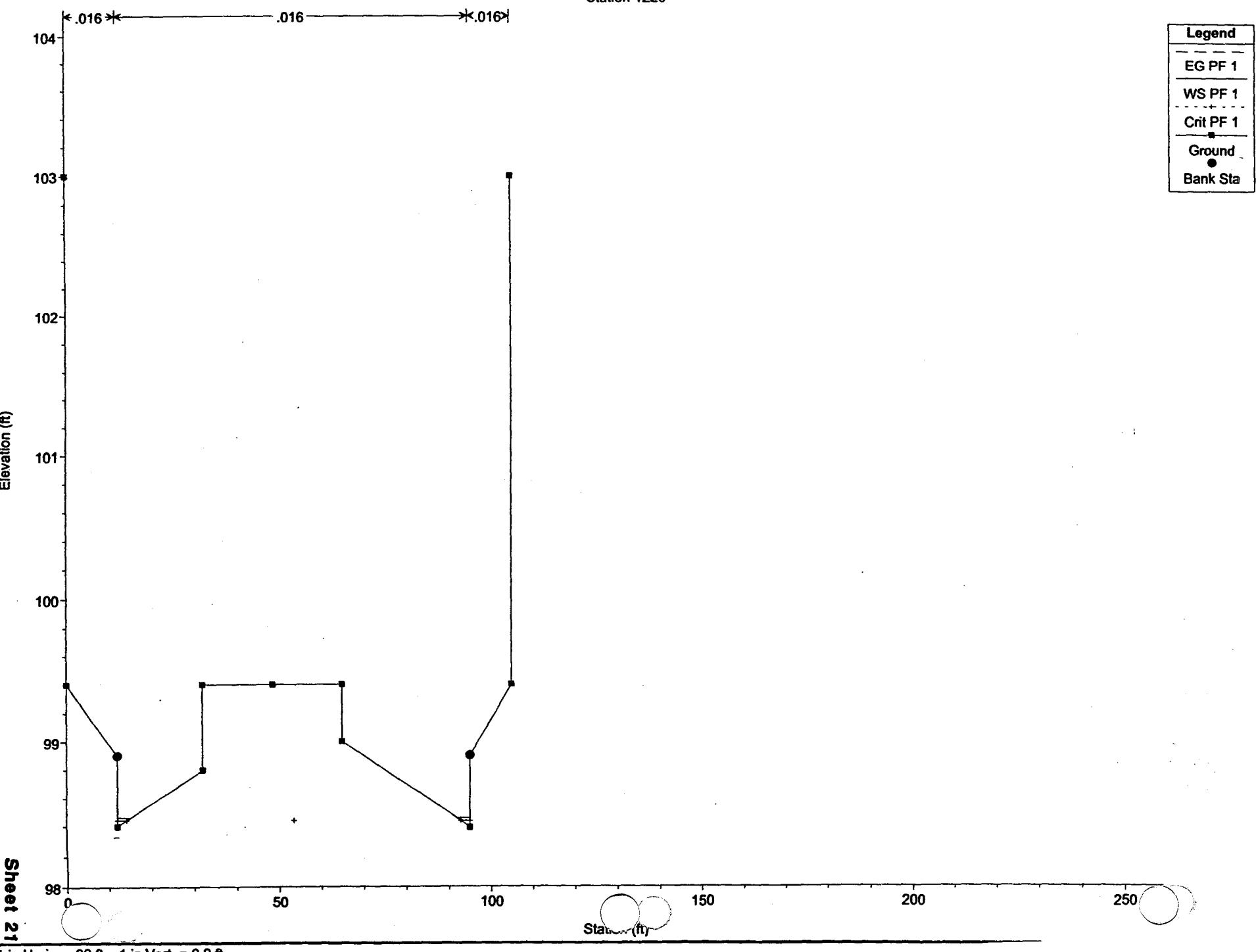
Ground

Bank Sta



Catellus Common 3rd final 12/01/00 12/01/00 Plan 11/29/00

Station 1220



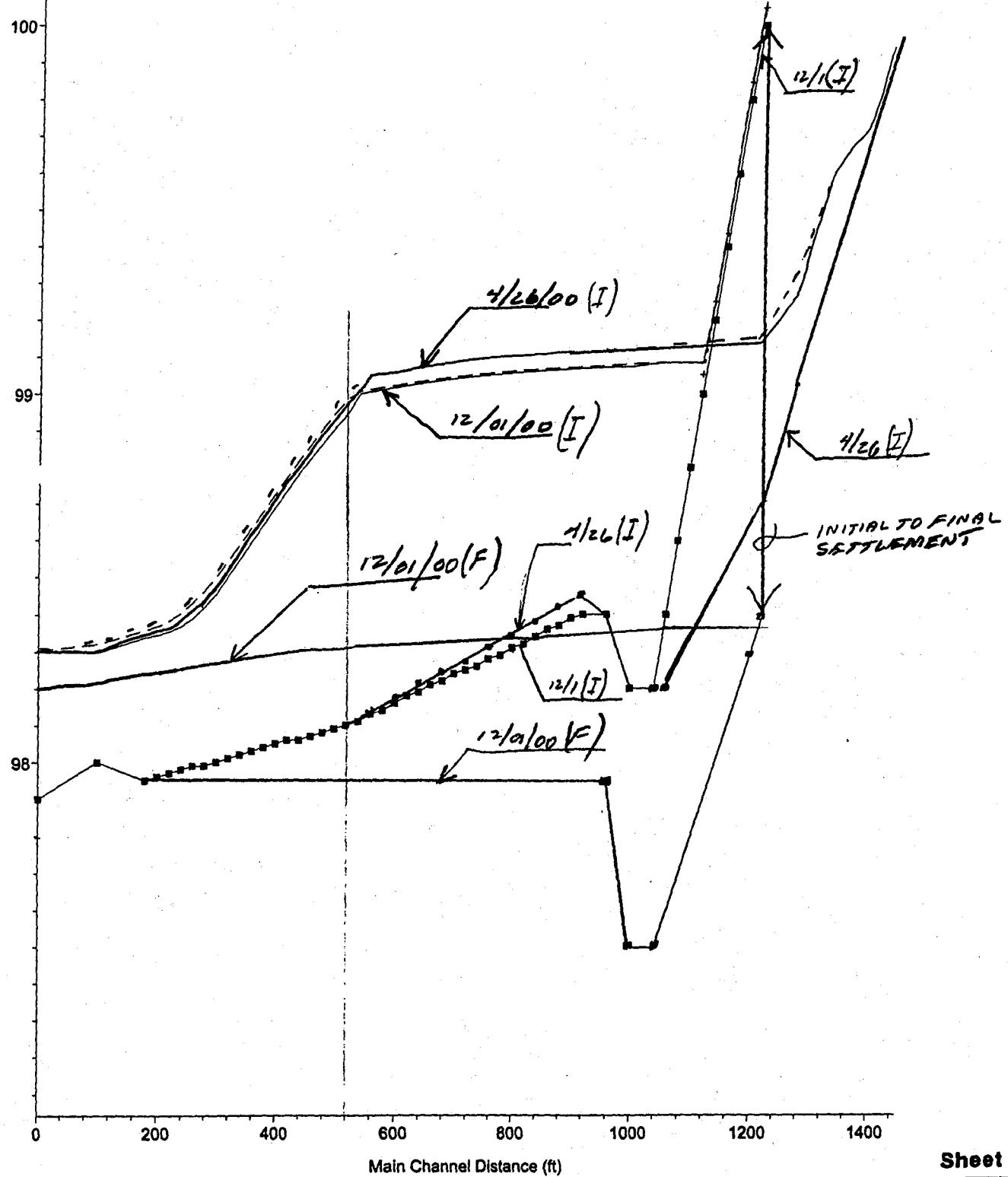
HEC-RAS Plat 100 River: 3rd_Common Reach: reach01

Reach	r Sta	Q Total	Min Ch El	W.S. Elev.	Crit W.S.	E.G. Ele	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
reach01	1220	0.10	98.40	98.44	98.44	98.46	0.023384	1.08	0.09	4.30	1.30
reach01	1200	0.10	98.30	98.37	98.34	98.37	0.002078	0.44	0.23	6.76	0.42
reach01	1180	0.10	98.20	98.37		98.37	0.000016	0.07	1.42	16.85	0.04
reach01	1160	0.10	98.10	98.37		98.37	0.000001	0.03	3.60	26.85	0.01
reach01	1140	0.10	98.00	98.37		98.37	0.000000	0.01	6.79	36.85	0.01
reach01	1120	0.10	97.90	98.37		98.37	0.000000	0.01	10.86	43.43	0.00
reach01	1100	0.10	97.80	98.37		98.37	0.000000	0.01	15.55	51.44	0.00
reach01	1080	0.10	97.70	98.37		98.37	0.000000	0.00	21.05	57.41	0.00
reach01	1060	0.10	97.60	98.37		98.37	0.000000	0.00	27.01	61.81	0.00
reach01	1040	13.60	97.50	98.37		98.37	0.000044	0.43	33.19	66.07	0.10
reach01	1000	13.60	97.50	98.36		98.36	0.000170	0.63	21.89	59.99	0.18
reach01	960	17.30	97.95	98.35		98.36	0.000109	0.23	40.47	107.17	0.07
reach01	920	17.30	97.95	98.35		98.35	0.000112	0.23	39.99	106.61	0.08
reach01	900	17.30	97.95	98.35		98.35	0.000113	0.23	40.03	107.96	0.08
reach01	880	17.30	97.95	98.34		98.35	0.000114	0.23	40.24	113.41	0.08
reach01	860	17.30	97.95	98.34		98.35	0.000114	0.22	40.71	120.41	0.08
reach01	840	17.30	97.95	98.34		98.35	0.000114	0.22	41.23	126.12	0.08
reach01	820	17.30	97.95	98.34		98.34	0.000113	0.22	41.99	132.81	0.07
reach01	800	17.30	97.95	98.34		98.34	0.000111	0.21	43.16	140.12	0.07
reach01	780	17.30	97.95	98.33		98.34	0.000107	0.21	44.58	146.32	0.07
reach01	760	17.30	97.95	98.33		98.34	0.000102	0.20	45.99	149.84	0.07
reach01	740	17.30	97.95	98.33		98.33	0.000096	0.19	47.50	153.95	0.07
reach01	720	17.30	97.95	98.33		98.33	0.000089	0.18	49.38	160.26	0.07
reach01	700	17.30	97.95	98.33		98.33	0.000082	0.17	51.53	168.19	0.06
reach01	680	17.30	97.95	98.33		98.33	0.000076	0.16	53.68	176.07	0.06
reach01	660	17.30	97.95	98.32		98.33	0.000069	0.15	56.15	184.67	0.06
reach01	640	17.30	97.95	98.32		98.33	0.000061	0.15	59.30	185.82	0.05
reach01	620	17.30	97.95	98.32		98.33	0.000054	0.15	62.53	186.98	0.05
reach01	600	17.30	97.95	98.32		98.32	0.000048	0.14	65.34	187.90	0.05
reach01	580	17.30	97.95	98.32		98.32	0.000043	0.14	68.09	188.82	0.05
reach01	560	17.30	97.95	98.32		98.32	0.000037	0.14	71.63	189.99	0.04
reach01	540	17.30	97.95	98.32		98.32	0.000033	0.13	75.13	191.16	0.04
reach01	520	40.10	97.95	98.31		98.32	0.000165	0.30	76.72	191.73	0.09
reach01	500	40.10	97.95	98.31		98.32	0.000169	0.30	76.07	191.57	0.09
reach01	480	40.10	97.95	98.31		98.31	0.000172	0.30	75.41	191.40	0.09
reach01	460	40.10	97.95	98.30		98.31	0.000177	0.30	74.73	191.23	0.10
reach01	440	40.10	97.95	98.30		98.31	0.000181	0.30	74.04	191.06	0.10
reach01	420	40.10	97.95	98.29		98.30	0.000185	0.31	73.33	190.88	0.10
reach01	400	40.10	97.95	98.29		98.30	0.000190	0.31	72.61	190.70	0.10
reach01	380	40.10	97.95	98.29		98.30	0.000196	0.31	71.86	190.51	0.10
reach01	360	40.10	97.95	98.28		98.29	0.000201	0.31	71.10	190.32	0.10
reach01	340	40.10	97.95	98.28		98.29	0.000207	0.31	70.31	190.12	0.10
reach01	320	40.10	97.95	98.27		98.28	0.000213	0.31	69.50	189.92	0.10

HEC-RAS Plot 700 River: 3rd Common Reach: reach01 (Continued)

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Ch W.S. (ft)	E.G. Elev. (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
reach01	300	40.10	97.95	98.27		98.28	0.000220	0.32	68.67	189.70	0.10
reach01	280	40.10	97.95	98.27		98.27	0.000227	0.32	67.81	189.49	0.11
reach01	260	40.10	97.95	98.26		98.27	0.000235	0.32	66.92	189.26	0.11
reach01	240	40.10	97.95	98.26		98.27	0.000243	0.32	66.00	189.03	0.11
reach01	220	40.10	97.95	98.25		98.26	0.000252	0.32	65.04	188.79	0.11
reach01	200	40.10	97.95	98.25		98.26	0.000262	0.32	64.06	188.54	0.11
reach01	180	40.10	97.95	98.24		98.25	0.000273	0.33	63.03	188.27	0.11
reach01	100	40.10	98.00	98.21		98.23	0.000353	0.33	56.20	186.91	0.13
reach01	00	40.10	97.90	98.20	97.80	98.20	0.000113	0.44	75.54	200.74	0.14

Legend
EG PF 1
WS PF 1
Crit PF 1
Ground

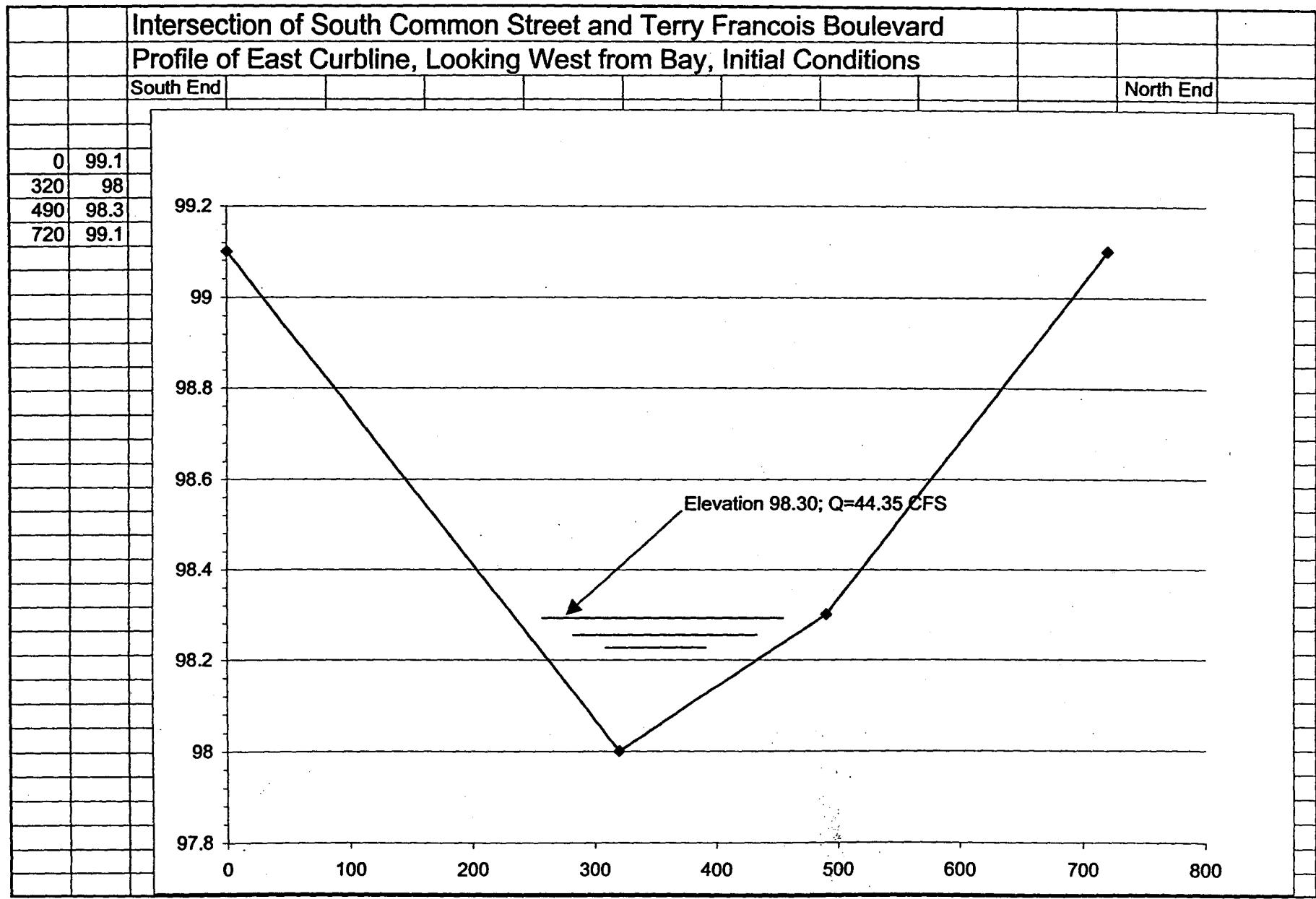


Weir Analysis at Overland Release Point

Basin 1 – Terry François Blvd. Release Point

(Initial and Final Conditions, 12/01/00)

The overland release weir analysis at Terry François Boulevard near South Commons Street follows. The east top of curb profile of Terry François Boulevard was used as the top of weir and the analysis was performed for both the initial conditions and the final conditions, fifty years hence. A weir coefficient of 2.5 was used. The quantity of flow, Q, was assumed to be the flow from a 100-year storm minus the flow from a 5-year storm, which was assumed to be carried away by the piping system. The Q's were calculated earlier in this Drainage Study. An examination of the HEC-RAS analysis presented earlier reveals that for initial conditions, the ponding elevation behind the weir has little influence on the water surface elevation at South Commons and 3rd Street. The same is not true for the final conditions.



Overland Flow (Weir Calculation) for Basin 1 at Release; Initial Grades; 100-yr minus 5-yr = 39.0 CFS							
12/1/00							
Weir Coefficient =	2.5						
Water level = 98.29; therefore add	-0.81	to weir hight (y) for first 320 feet section (starting at ele 99.1)					
Water level = 98.29; therefore add	-0.01	to weir hight (y) for second 170 feet section (starting at ele 98.3)					
Water level = 98.29; therefore add	-0.81	to weir hight (y) for third 230 feet section (starting at 99.1)					
Total Q from all three top of curb weir sections and water elevation at 98.29 equals:							40.81 cfs
q=2.5h ^{2.5} (3/2)							
							Flow (cfs) versus Elevation
x	y	Q	Total Q		37.45	98.28	(use top of water ele at 98.30)
distance	distance	cfs			40.81	98.29	
(south most 320 foot length of curb)					44.35	98.3	
0	0	0	0				
5	0.017188	0	0				
10	0.034375	0	0				
15	0.051563	0	0				
20	0.06875	0	0				
25	0.085938	0	0				
30	0.103125	0	0				
35	0.120313	0	0				
40	0.1375	0	0				
45	0.154688	0	0				
50	0.171875	0	0				
55	0.189063	0	0				
60	0.20625	0	0				
65	0.223438	0	0				
70	0.240625	0	0				
75	0.257813	0	0				
80	0.275	0	0				
85	0.292188	0	0				
90	0.309375	0	0				
95	0.326563	0	0				
100	0.34375	0	0				
105	0.360938	0	0				
110	0.378125	0	0				
115	0.395313	0	0				
120	0.4125	0	0				
125	0.429688	0	0				
130	0.446875	0	0				
135	0.464063	0	0				
140	0.48125	0	0				
145	0.498438	0	0				
150	0.515625	0	0				
155	0.532813	0	0				
160	0.55	0	0				
165	0.567188	0	0				
170	0.584375	0	0				
175	0.601563	0	0				
180	0.61875	0	0				
185	0.635938	0	0				
190	0.653125	0	0				

195	0.670313	0	0						
200	0.6875	0	0						
205	0.704688	0	0						
210	0.721875	0	0						
215	0.739063	0	0						
220	0.75625	0	0						
225	0.773438	0	0						
230	0.790625	0	0						
235	0.807813	0	0						
240	0.825	0.022964	0.022964						
245	0.842188	0.072184	0.095148						
250	0.859375	0.137142	0.23229						
255	0.876563	0.214662	0.446952						
260	0.89375	0.302961	0.749913						
265	0.910938	0.400856	1.150769						
270	0.928125	0.507484	1.658254						
275	0.945313	0.622181	2.280435						
280	0.9625	0.744414	3.02485						
285	0.979688	0.873745	3.898595						
290	0.996875	1.009803	4.908398						
295	1.014063	1.152271	6.06067						
300	1.03125	1.300873	7.361543						
305	1.048438	1.455365	8.816907						
310	1.065625	1.61553	10.43244						
315	1.082813	1.781174	12.21361						
320	1.1	1.952122	14.16573						

(center 170 foot section of curb)			
0	0	0	0
5	0.008824	0	0
10	0.017647	0.008359	0.008359
15	0.026471	0.026422	0.034781
20	0.035294	0.050285	0.085067
25	0.044118	0.078773	0.16384
30	0.052941	0.11123	0.275069
35	0.061765	0.147218	0.422287
40	0.070588	0.18642	0.608707
45	0.079412	0.228591	0.837299
50	0.088235	0.273536	1.110834
55	0.097059	0.321092	1.431926
60	0.105882	0.371123	1.803049
65	0.114706	0.423513	2.226562
70	0.123529	0.478159	2.704722
75	0.132353	0.534973	3.239694
80	0.141176	0.593873	3.833568
85	0.15	0.65479	4.488358
90	0.158824	0.717658	5.206016
95	0.167647	0.782418	5.988434
100	0.176471	0.849017	6.83745
105	0.185294	0.917405	7.754855
110	0.194118	0.987536	8.742392
115	0.202941	1.059369	9.801761
120	0.211765	1.132864	10.93463
125	0.220588	1.207984	12.14261
130	0.229412	1.284695	13.4273
135	0.238235	1.362963	14.79027
140	0.247059	1.44276	16.23303
145	0.255882	1.524056	17.75708
150	0.264706	1.606825	19.36391
155	0.273529	1.691039	21.05495
160	0.282353	1.776676	22.83162
165	0.291176	1.863711	24.69533
170	0.3	1.952122	26.64746

(north most 230 foot section of curb)			
0	0	0	0
5	0.017391	0	0
10	0.034783	0	0
15	0.052174	0	0
20	0.069565	0	0
25	0.086957	0	0
30	0.104348	0	0
35	0.121739	0	0
40	0.13913	0	0
45	0.156522	0	0
50	0.173913	0	0
55	0.191304	0	0
60	0.208696	0	0
65	0.226087	0	0
70	0.243478	0	0
75	0.26087	0	0
80	0.278261	0	0
85	0.295652	0	0
90	0.313043	0	0
95	0.330435	0	0
100	0.347826	0	0
105	0.365217	0	0
110	0.382609	0	0
115	0.4	0	0
120	0.417391	0	0
125	0.434783	0	0
130	0.452174	0	0
135	0.469565	0	0
140	0.486957	0	0
145	0.504348	0	0
150	0.521739	0	0
155	0.53913	0	0
160	0.556522	0	0
165	0.573913	0	0
170	0.591304	0	0
175	0.608696	0	0
180	0.626087	0	0
185	0.643478	#NUM!	0
190	0.66087	#NUM!	0
195	0.678261	#NUM!	0
200	0.695652	#NUM!	0
205	0.713043	#NUM!	0
210	0.730435	#NUM!	0
215	0.747826	#NUM!	0
220	0.765217	#NUM!	0
225	0.782609	#NUM!	0
230	0.8	#NUM!	0

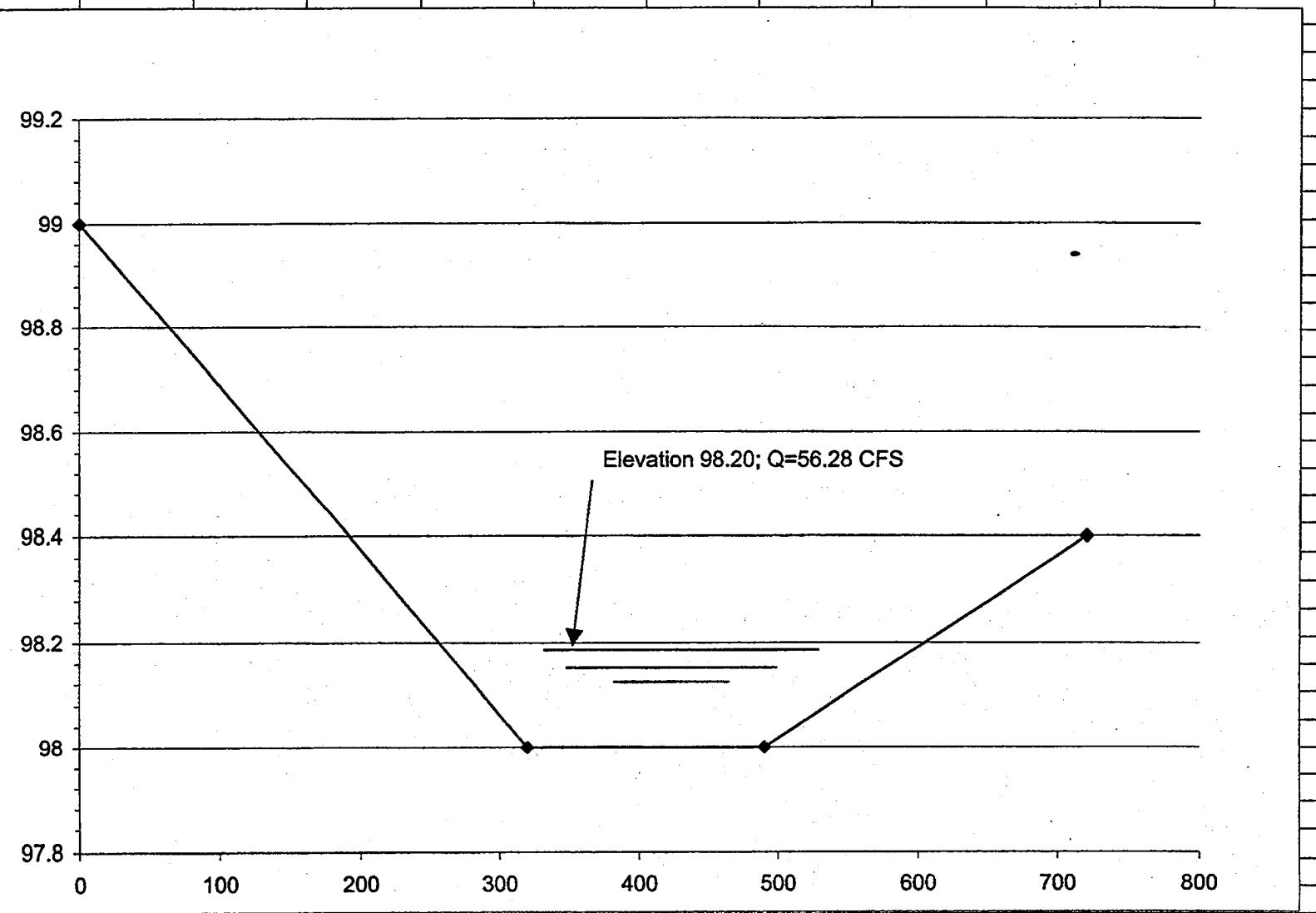
Intersection of South Common Street and Terry Francois Boulevard

Profile of East Curbline, Looking West from Bay, Final Conditions

South End

North End

0	99
320	98
490	98
720	98.4



Overland Flow (Weir Calculation) for Basin 1 at Release; Final Grades; 100-yr minus 5-yr = 40.10 CFS

12/1/00

Weir Coefficient = 2.5

Water level = 98.17; therefore add -0.83 to weir hight (y) for first 320 feet section (starting at ele 99.0)

Water level = 98.17; therefore add 0.17 to weir hight (y) for second 170 feet section (constant at ele 98.0)

Water level = 98.17; therefore add -0.23 to weir hight (y) for third 230 feet section (starting at 98.4)

Total Q from all three top of curb weir sections and water elevation at 98.29 equals:

42.22 cfs

$q=2.5h^{(3/2)}$

Flow (cfs) versus Elevation

x distance	y distance	Q cfs	Total Q	17.07	98.10	(use top of water ele at 98.20)
(south most 320 foot length of curb)				33.96	98.15	
0	0	#NUM!	#NUM!	42.22	98.17	
5	0.015625	#NUM!	#NUM!	56.28	98.2	
10	0.03125	#NUM!	#NUM!	84.24	98.25	
15	0.046875	#NUM!	#NUM!			
20	0.0625	#NUM!	#NUM!			
25	0.078125	#NUM!	#NUM!			
30	0.09375	#NUM!	#NUM!			
35	0.109375	#NUM!	#NUM!			
40	0.125	#NUM!	#NUM!			
45	0.140625	#NUM!	#NUM!			
50	0.15625	#NUM!	#NUM!			
55	0.171875	#NUM!	#NUM!			
60	0.1875	#NUM!	#NUM!			
65	0.203125	#NUM!	#NUM!			
70	0.21875	#NUM!	#NUM!			
75	0.234375	#NUM!	#NUM!			
80	0.25	#NUM!	#NUM!			
85	0.265625	#NUM!	#NUM!			
90	0.28125	#NUM!	#NUM!			
95	0.296875	#NUM!	#NUM!			
100	0.3125	#NUM!	#NUM!			
105	0.328125	#NUM!	#NUM!			
110	0.34375	#NUM!	#NUM!			
115	0.359375	#NUM!	#NUM!			
120	0.375	#NUM!	#NUM!			
125	0.390625	#NUM!	#NUM!			
130	0.40625	#NUM!	#NUM!			
135	0.421875	#NUM!	#NUM!			
140	0.4375	#NUM!	#NUM!			
145	0.453125	#NUM!	#NUM!			
150	0.46875	#NUM!	#NUM!			
155	0.484375	#NUM!	#NUM!			
160	0.5	#NUM!	#NUM!			
165	0.515625	#NUM!	#NUM!			
170	0.53125	#NUM!	#NUM!			
175	0.546875	#NUM!	#NUM!			
180	0.5625	#NUM!	#NUM!			
185	0.578125	#NUM!	#NUM!			
190	0.59375	#NUM!	#NUM!			
195	0.609375	#NUM!	#NUM!			

	200	0.625	#NUM!	#NUM!							
	205	0.640625	#NUM!	#NUM!							
	210	0.65625	#NUM!	#NUM!							
	215	0.671875	#NUM!	#NUM!							
	220	0.6875	#NUM!	#NUM!							
	225	0.703125	#NUM!	#NUM!							
	230	0.71875	#NUM!	#NUM!							
	235	0.734375	#NUM!	#NUM!							
	240	0.75	#NUM!	#NUM!							
	245	0.765625	#NUM!	#NUM!							
	250	0.78125	#NUM!	#NUM!							
	255	0.796875	#NUM!	#NUM!							
	260	0.8125	#NUM!	#NUM!							
	265	0.828125	#NUM!	0							
	270	0.84375	0.020154	0.020154							
	275	0.859375	0.062933	0.083087							
	280	0.875	0.119324	0.202411							
	285	0.890625	0.18659	0.389001							
	290	0.90625	0.26319	0.652191							
	295	0.921875	0.348102	1.000293							
	300	0.9375	0.440578	1.440871							
	305	0.953125	0.540044	1.980915							
	310	0.96875	0.64604	2.626955							
	315	0.984375	0.758185	3.385141							
	320	1	0.87616	4.2613							

(center 170 foot section of curb)								
0	0	0.87616	0.87616					
5	0	0.87616	1.75232					
10	0	0.87616	2.62848					
15	0	0.87616	3.50464					
20	0	0.87616	4.3808					
25	0	0.87616	5.25696					
30	0	0.87616	6.13312					
35	0	0.87616	7.00928					
40	0	0.87616	7.88544					
45	0	0.87616	8.761599					
50	0	0.87616	9.637759					
55	0	0.87616	10.51392					
60	0	0.87616	11.39008					
65	0	0.87616	12.26624					
70	0	0.87616	13.1424					
75	0	0.87616	14.01856					
80	0	0.87616	14.89472					
85	0	0.87616	15.77088					
90	0	0.87616	16.64704					
95	0	0.87616	17.5232					
100	0	0.87616	18.39936					
105	0	0.87616	19.27552					
110	0	0.87616	20.15168					
115	0	0.87616	21.02784					
120	0	0.87616	21.904					
125	0	0.87616	22.78016					
130	0	0.87616	23.65632					
135	0	0.87616	24.53248					
140	0	0.87616	25.40864					
145	0	0.87616	26.2848					
150	0	0.87616	27.16096					
155	0	0.87616	28.03712					
160	0	0.87616	28.91328					
165	0	0.87616	29.78944					
170	0	0.87616	30.6656					

(north most 230 foot section of curb)			
0	0	#NUM!	#NUM!
5	0.008696	#NUM!	#NUM!
10	0.017391	#NUM!	#NUM!
15	0.026087	#NUM!	#NUM!
20	0.034783	#NUM!	#NUM!
25	0.043478	#NUM!	#NUM!
30	0.052174	#NUM!	#NUM!
35	0.06087	#NUM!	#NUM!
40	0.069565	#NUM!	#NUM!
45	0.078261	#NUM!	#NUM!
50	0.086957	#NUM!	#NUM!
55	0.095652	#NUM!	#NUM!
60	0.104348	#NUM!	#NUM!
65	0.113043	#NUM!	#NUM!
70	0.121739	#NUM!	#NUM!
75	0.130435	#NUM!	#NUM!
80	0.13913	#NUM!	#NUM!
85	0.147826	#NUM!	#NUM!
90	0.156522	#NUM!	#NUM!
95	0.165217	#NUM!	#NUM!
100	0.173913	#NUM!	#NUM!
105	0.182609	#NUM!	#NUM!
110	0.191304	#NUM!	#NUM!
115	0.2	#NUM!	#NUM!
120	0.208696	#NUM!	#NUM!
125	0.217391	#NUM!	#NUM!
130	0.226087	#NUM!	0
135	0.234783	0.004134	0.004134
140	0.243478	0.01956	0.023694
145	0.252174	0.041274	0.064968
150	0.26087	0.067796	0.132764
155	0.269565	0.098374	0.231138
160	0.278261	0.132526	0.363664
165	0.286957	0.169912	0.533577
170	0.295652	0.210273	0.74385
175	0.304348	0.253403	0.997253
180	0.313043	0.299136	1.296389
185	0.321739	0.34733	1.643719
190	0.330435	0.397865	2.041584
195	0.33913	0.450639	2.492223
200	0.347826	0.505559	2.997783
205	0.356522	0.562546	3.560328
210	0.365217	0.621525	4.181854
215	0.373913	0.682433	4.864287
220	0.382609	0.74521	5.609498
225	0.391304	0.809803	6.4193
230	0.4	0.87616	7.29546

Weir Analysis at Overland Release Point

Basin 5 – Round About Release Point

(Initial Conditions, 4/26/00)

The overland release weir analysis at the Round About follows. The west top of curb profile of the Round About was used as the top of weir and the analysis was performed for the initial conditions only. A weir coefficient of 2.5 was used. The quantity of flow, Q, was assumed to be the flow from a 100-year storm minus the flow from a 5-year storm. The 5-year storm was assumed to be carried away by the piping system. The Q's were calculated earlier in this Drainage Study

Overland Flow (Weir Calculation) for Basins 3, 4 & 5 at Roundabout; Initial Grades; 100-yr minus 5-yr = 58.2 CFS

4/26/00

Weir Coefficient = 2.5

Water level = 98.60; therefore add 0 to weir height (y) for first 80 feet section

Water level = 98.60; therefore add 0.4 to weir height (y) for second 70 feet section

Water level = 98.60; therefore add 0 to weir height (y) for third 80 feet section

Water level = 98.60; therefore add 0.4 to weir height (y) for fourth 90 feet section

Total Q from all four top of curb weir sections and elevation 98.6 equals: 157.04

$q=2.5h^{(3/2)}$

Flow (cfs) versus Elevation

x distance	y distance	Q cfs	Total Q	157.04	98.60
(north most 80 foot length of curb)				99.63	98.50
0	0	0	0	23.73	98.30
5	0.025	0.049411	0.049411	0	98.1
10	0.05	0.139754	0.189165		
15	0.075	0.256745	0.44591	60	98.41
20	0.1	0.395285	0.841194		
25	0.125	0.552427	1.393622		
30	0.15	0.726184	2.119806		
35	0.175	0.915097	3.034903		
40	0.2	1.118034	4.152937		
45	0.225	1.334086	5.487023		
50	0.25	1.5625	7.049523		
55	0.275	1.80264	8.852163		
60	0.3	2.05396	10.90612		
65	0.325	2.315981	13.2221		
70	0.35	2.588285	15.81039		
75	0.375	2.870496	18.68088		
80	0.4	0	18.68088		

(just north of center 70 foot section of curb)

0	0	3.162278	3.162278
5	0.007143	3.247359	6.409636
10	0.014286	3.333189	9.742825
15	0.021429	3.419763	13.16259
20	0.028571	3.507073	16.66966
25	0.035714	3.595114	20.26478
30	0.042857	3.68388	23.94866
35	0.05	3.773365	27.72202
40	0.057143	3.863562	31.58558
45	0.064286	3.954467	35.54005
50	0.071429	4.046074	39.58612
55	0.078571	4.138378	43.7245
60	0.085714	4.231373	47.95588
65	0.092857	4.325055	52.28093
70	0.1	0	52.28093

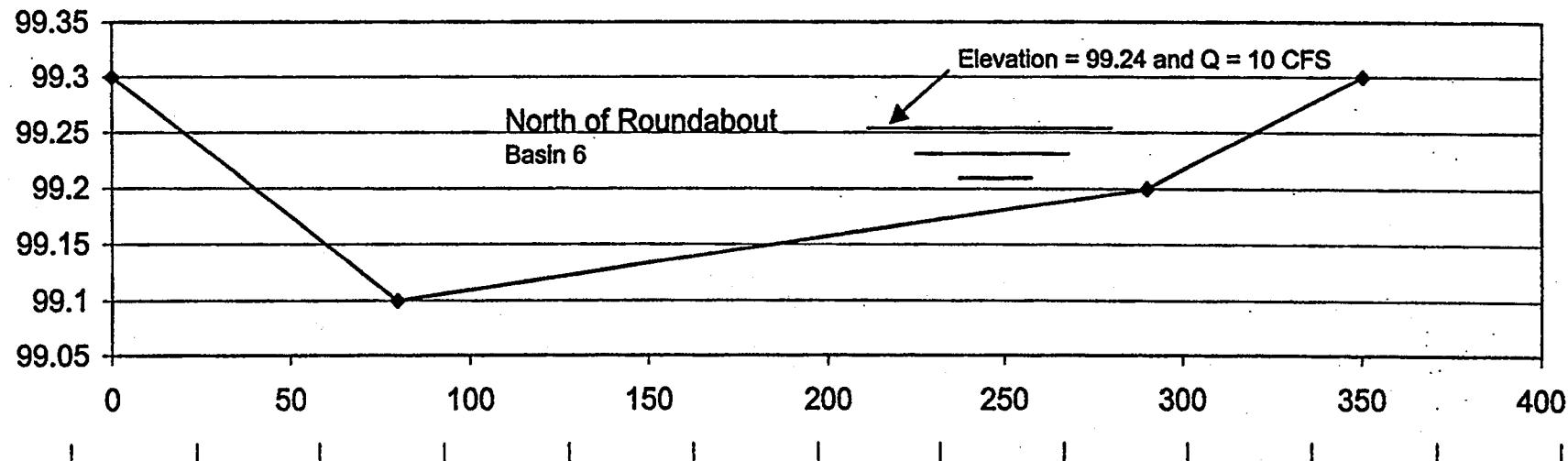
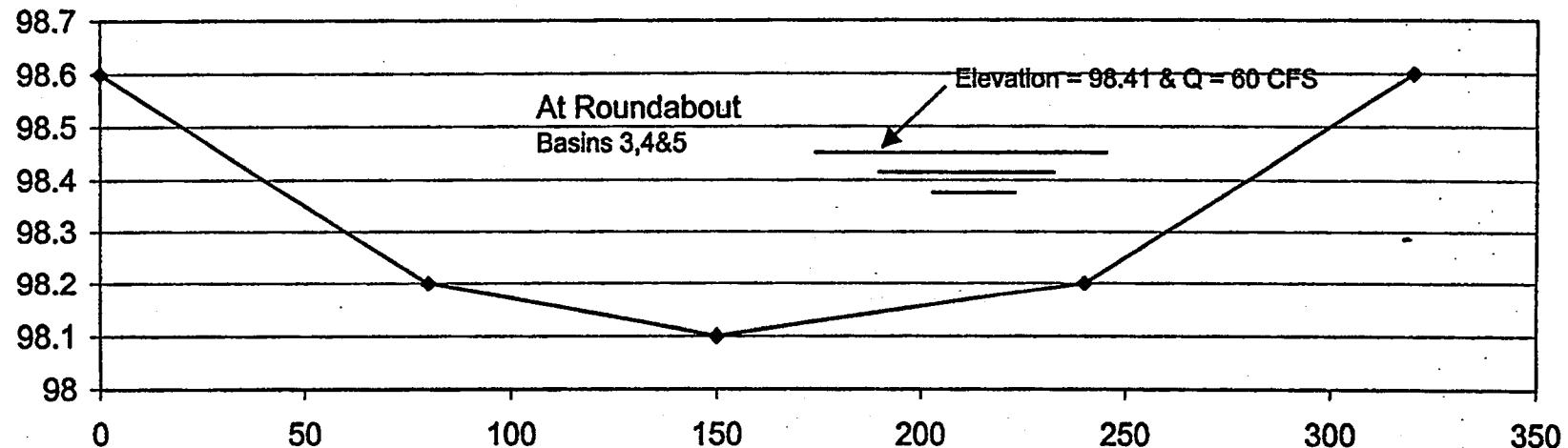
(south most 80 foot section of curb)			
0	0	0	0
5	0.025	0.049411	0.049411
10	0.05	0.139754	0.189165
15	0.075	0.256745	0.44591
20	0.1	0.395285	0.841194
25	0.125	0.552427	1.393622
30	0.15	0.726184	2.119806
35	0.175	0.915097	3.034903
40	0.2	1.118034	4.152937
45	0.225	1.334086	5.487023
50	0.25	1.5625	7.049523
55	0.275	1.80264	8.852163
60	0.3	2.05396	10.90612
65	0.325	2.315981	13.2221
70	0.35	2.588285	15.81039
75	0.375	2.870496	18.68088
80	0.4	0	18.68088
(just south of center 90 foot section of curb)			
0	0	3.162278	3.162278
5	0.005556	3.228387	6.390664
10	0.011111	3.29495	9.685614
15	0.016667	3.361965	13.04758
20	0.022222	3.429428	16.47701
25	0.027778	3.497336	19.97434
30	0.033333	3.565687	23.54003
35	0.038889	3.634477	27.17451
40	0.044444	3.703704	30.87821
45	0.05	3.773365	34.65157
50	0.055556	3.843457	38.49503
55	0.061111	3.913978	42.40901
60	0.066667	3.984925	46.39393
65	0.072222	4.056296	50.45023
70	0.077778	4.128088	54.57832
75	0.083333	4.200298	58.77862
80	0.088889	4.272925	63.05154
85	0.094444	4.345965	67.39751
90	0.1	0	67.39751

Overland Flow (Weir Calculation) for Basin 6, North of Roundabout, Initial Grades; 100-yr minus 5-yr = 9.1 CFS						
04/26/00						
Weir Coefficient =	2.5					
Water level = 99.3; therefore add	0	to weir hight (y) for first 80 feet section				
Water level = 99.3; therefore add	0	to weir hight (y) for second 60 feet section				
Water level = 99.3; therefore add	0.1	to weir hight (y) for third 110 feet section				
Total Q from all four top of curb weir sections equals:			24.15	CFS		
q=2.5h ^{**} (3/2)		*				
					Elevation versus Flow	
	x	y	Q	Total Q	99.10	0.00 CFS
	distance	distance	cfs		99.2	4.36 CFS
(north most 80 foot length of curb)					99.24	10.2 CFS
	0	0	0	0	99.26	14.13 CFS
	5	0.0125	0.017469	0.017469	99.30	24.15 CFS
	10	0.025	0.049411	0.06688		
	15	0.0375	0.090773	0.157653		
	20	0.05	0.139754	0.297407		
	25	0.0625	0.195313	0.49272		
	30	0.075	0.256745	0.749465		
	35	0.0875	0.323536	1.073		
	40	0.1	0.395285	1.468285 *		
	45	0.1125	0.471671	1.939956		
	50	0.125	0.552427	2.492383		
	55	0.1375	0.63733	3.129712		
	60	0.15	0.726184	3.855897		
	65	0.1625	0.818823	4.67472		
	70	0.175	0.915097	5.589817		
	75	0.1875	1.014874	6.60469		
	80	0.2	0	6.60469		
(south most 60 foot section of curb)						
	0	0	0	0		
	5	0.008333	0.009509	0.009509		
	10	0.016667	0.026896	0.036405		
	15	0.025	0.049411	0.085815		
	20	0.033333	0.076073	0.161888		
	25	0.041667	0.106315	0.268203		
	30	0.05	0.139754	0.407957		
	35	0.058333	0.17611	0.584067		
	40	0.066667	0.215166	0.799233		
	45	0.075	0.256745	1.055978		
	50	0.083333	0.300703	1.356681		
	55	0.091667	0.346918	1.7036		
	60	0.1	0	1.7036 *		

(middle 110 foot section of curb)				
0	0	0.395285	0.395285	
5	0.004545	0.42254	0.817825	
10	0.009091	0.450394	1.268219	
15	0.013636	0.478835	1.747054	
20	0.018182	0.507851	2.254905	
25	0.022727	0.53743	2.792334	
30	0.027273	0.567562	3.359896	
35	0.031818	0.598237	3.958133	
40	0.036364	0.629445	4.587578	
45	0.040909	0.661178	5.248756	
50	0.045455	0.693427	5.942183	
55	0.05	0.726184	6.668368	
60	0.054545	0.759442	7.427809	
65	0.059091	0.793192	8.221001	
70	0.063636	0.827427	9.048428	
75	0.068182	0.862142	9.910569	
80	0.072727	0.897328	10.8079	
85	0.077273	0.932981	11.74088	
90	0.081818	0.969094	12.70997	
95	0.086364	1.005661	13.71563	
100	0.090909	1.042677	14.75831	
105	0.095455	1.080137	15.83845	
110	0.1	0	15.83845	

WEST TOP OF CURB PROFILES NEAR ROUNDABOUT, (looking from China Basin Channel); initial

0	98.6	0	99.3
80	98.2	80	99.1
150	98.1	290	99.2
240	98.2	350	99.3
320	98.6		



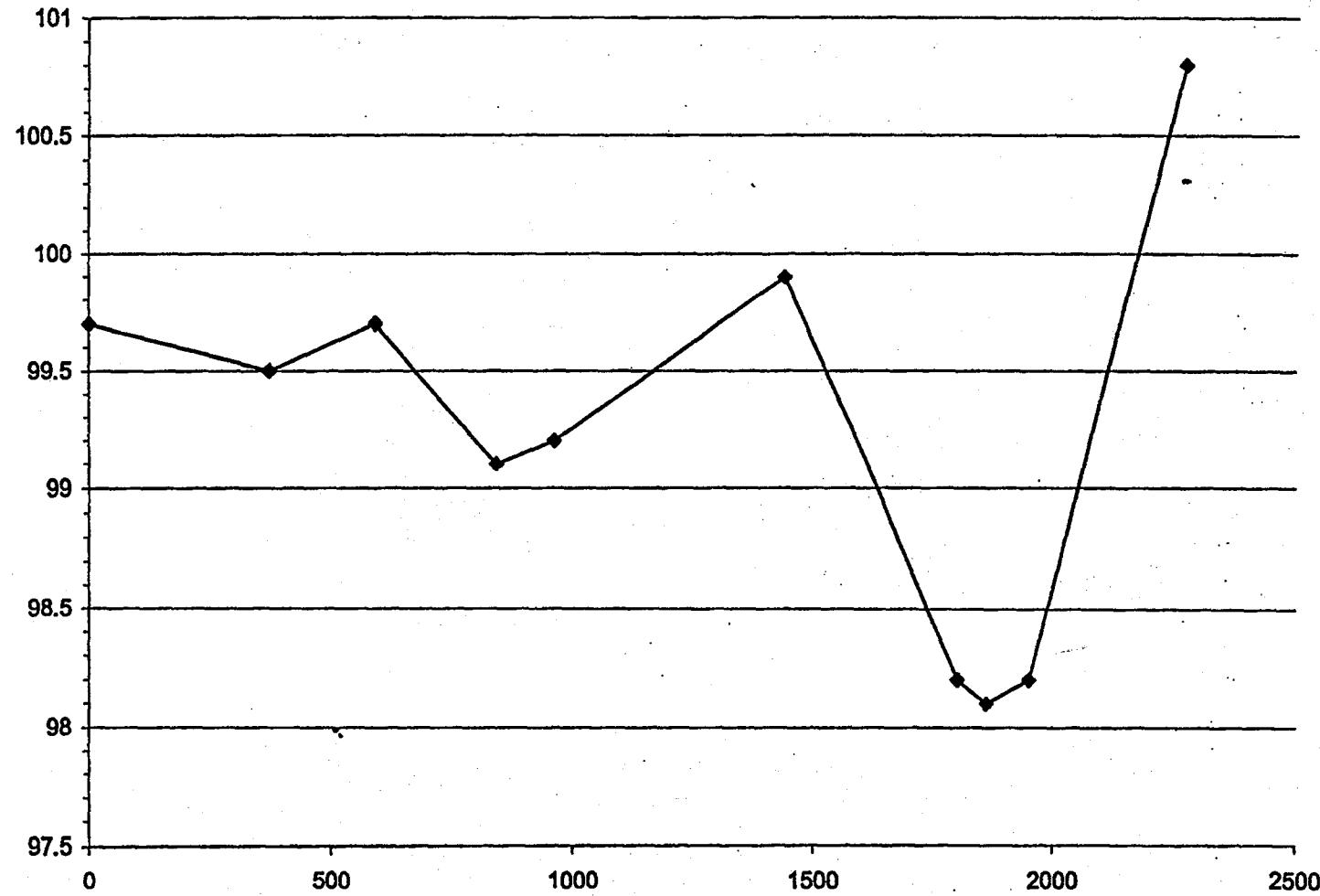
Profile of West Curbline, Looking from China Basin Channel

Initial Conditions

North End

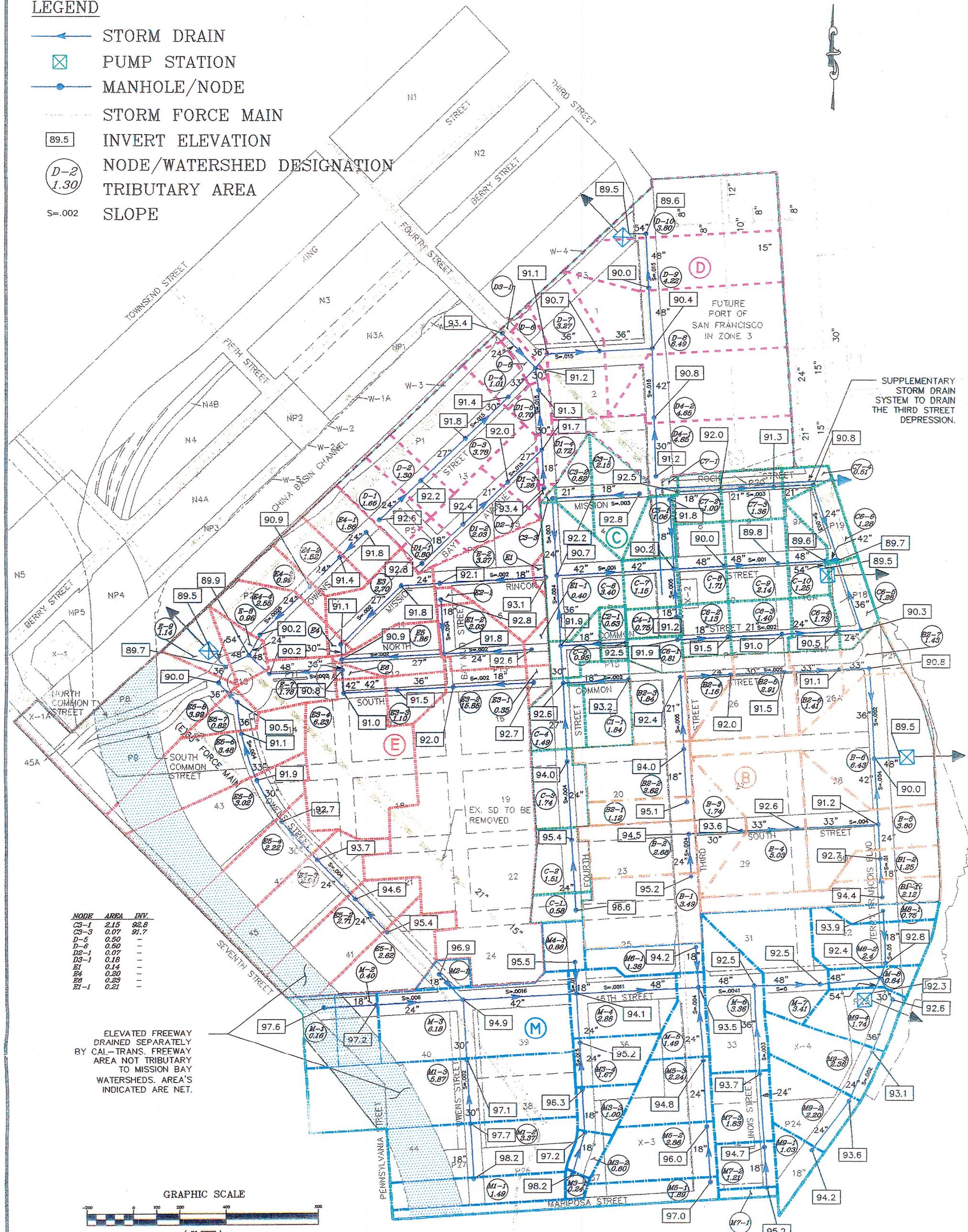
South End

0	99.7
370	99.5
590	99.7
840	99.1
960	99.2
1440	99.9
1800	98.2
1860	98.1
1950	98.2
2270	100.8



LEGEND

- > STORM DRAIN
- PUMP STATION
- MANHOLE/NODE
- STORM FORCE MAIN
- 89.5 INVERT ELEVATION
- D-2 NODE/WATERSHED DESIGNATION
- 1.30 TRIBUTARY AREA
- S=002 SLOPE



SEPARATED STORM DRAIN SYSTEM

Designed by MM	JOB NO. 0558	Scale 1" = 200'	CATELLUS DEVELOPMENT CORPORATION			MUNICIPAL ENGINEERING RAILROAD ENGINEERING SURVEYING PLANNING 1355 WILLOW WAY, SUITE 280+CONCORD, CA. 94520	SANTINA & THOMPSON, INC. Hawk Engineers, Inc. 594 HOWARD STREET - SUITE 202 SAN FRANCISCO, CALIFORNIA 94105
Drawn by MB	Sheet No. 1	Revision No.	Date	Project MISSION BAY PROJECT	Sheet Title SEPARATED STORM DRAIN SYSTEM 5 YEAR DESIGN STORM WATERSHED MAP	CATELLUS DEVELOPMENT CORPORATION	
Checked MM							
Cad File: AREAS	of 1 Sheets						
Date 12-1-00							

LEGEND

- (4) WATERSHED DESIGNATION
 (C) WATERSHED SUBAREA DESIGNATION

100.7 INITIAL (PRE-SETTLEMENT) GRADES
 AS SHOWN ON GRADING PLAN DATED 4/26/00

* NO GRADING PLANNED AT THESE LOCATIONS.
 EXISTING GRADES SHOWN.

⊕ LOW POINT

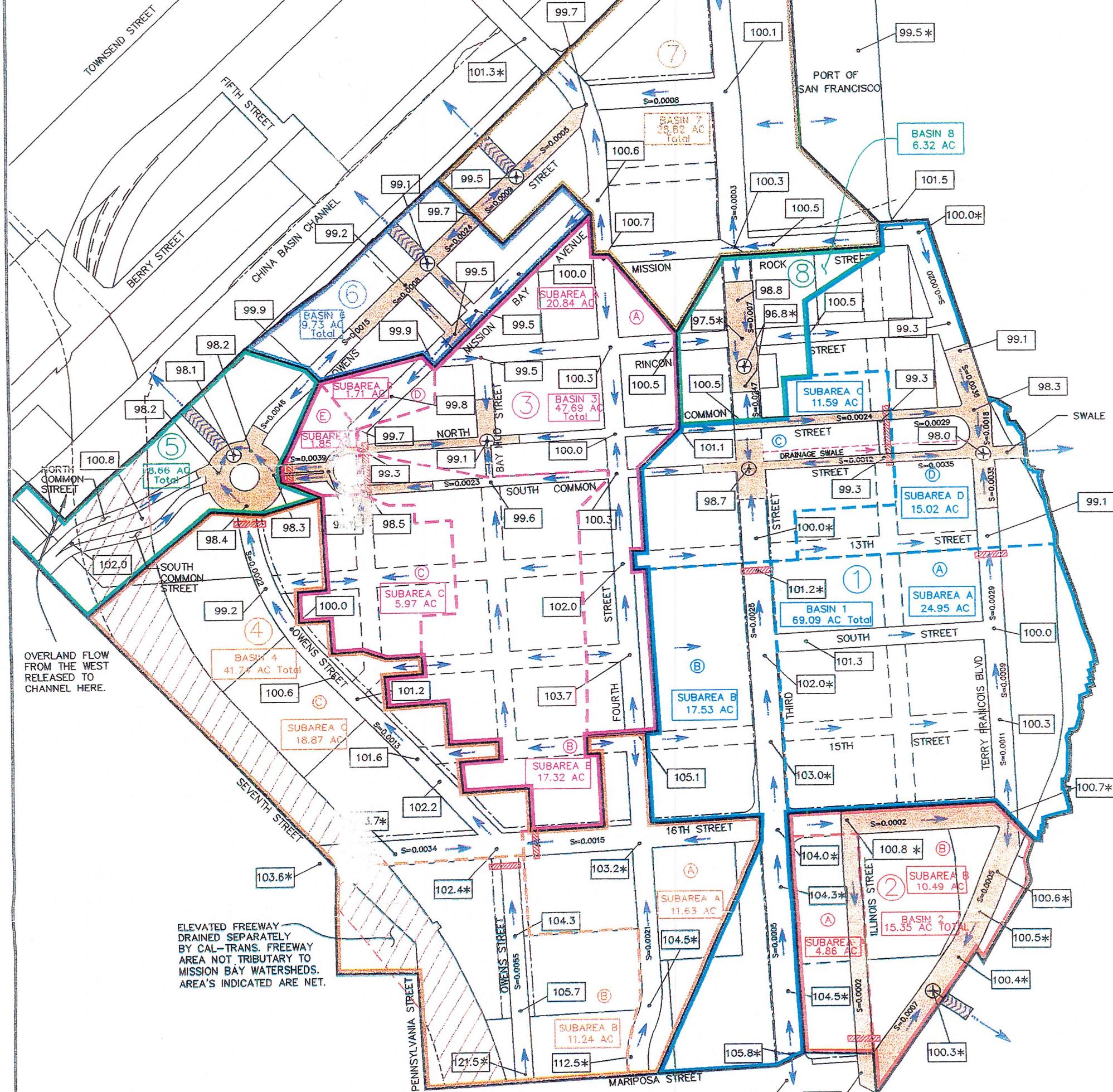
← OVERLAND RELEASE

S=0.004 SLOPE

/ STREET FLOW SECTION

MAXIMUM PONDING PRIOR
 TO RELEASE

← FLOW DIRECTION



CATELLUS DEVELOPMENT CORPORATION

MISSION BAY PROJECT
 WATERSHED MAP FOR OVERLAND FLOW
 based on
 INITIAL (PRE-SETTLEMENT) GRADES

MUNICIPAL ENGINEERING
 RAILROAD ENGINEERING
 SURVEYING
 PLANNING
 1355 WILLOW WAY, SUITE 280 • CONCORD, CA 94520

SANTINA &
 THOMPSON INC.

Hawk
 Engineers, Inc.
 655 HOWARD STREET
 SAN FRANCISCO, CALIFORNIA 94105

CATELLUS
 DEVELOPMENT CORPORATION

Designed by MM	JOB NO. 0558	Scale AS SHOWN
Drawn by JME	Sheet No. 1	Revision No. Date
Checked MM		
Cod File: 5581PF01D	of 1 Sheets	Project
Date 12-1-00		

LEGEND

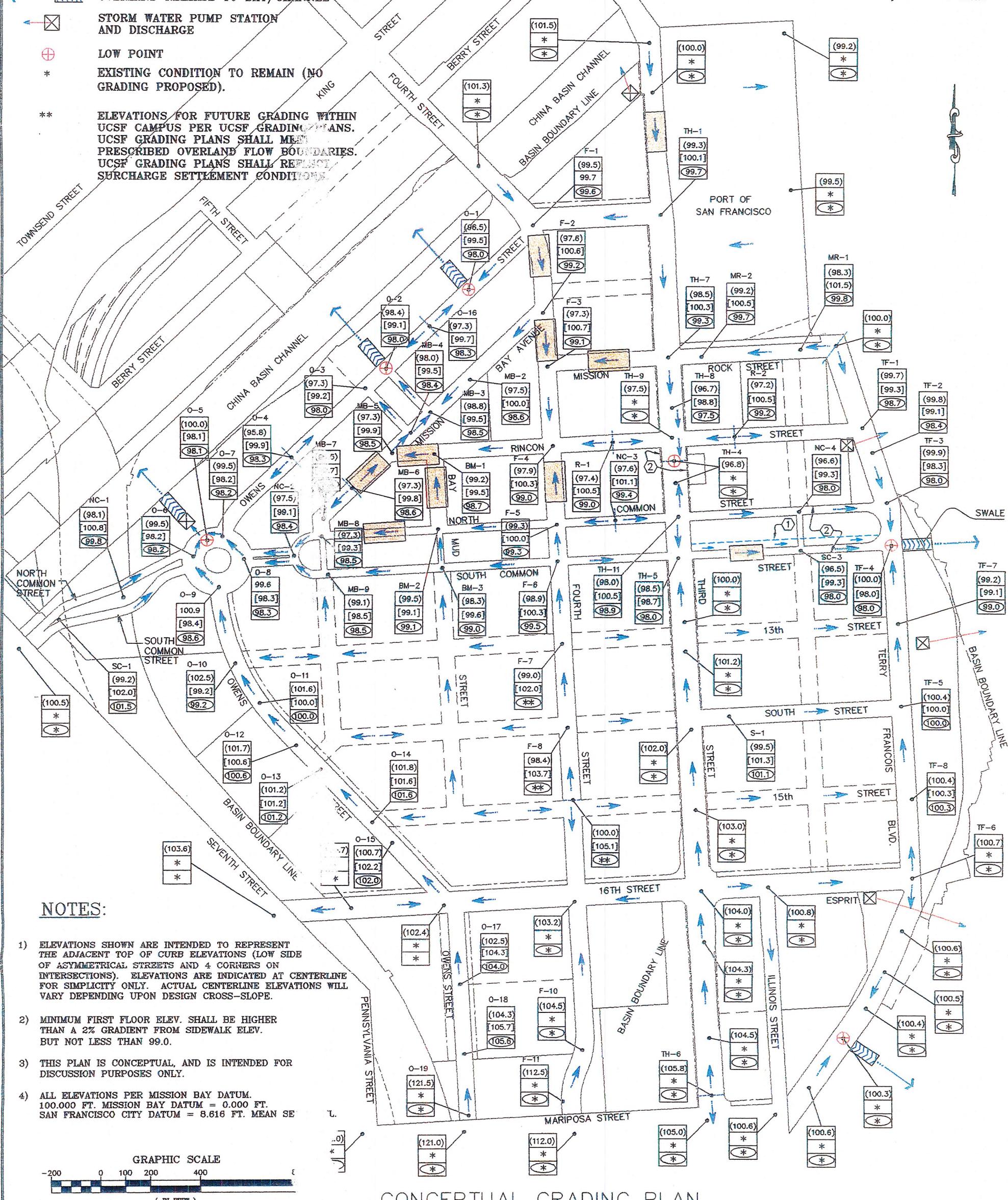
SYMBOL	DESCRIPTION
(xxx.x)	EXISTING ELEVATION
[xxx.x]	INITIAL ELEVATION
xxx.x	FINAL ELEVATION (POST 50 YEARS SETTLEMENT)
←	FLOW DIRECTION BASED ON FINAL GRADES
→	FLOW DIRECTION FOR FINAL GRADES (FLOWS IN OPPOSITE DIRECTION BASED ON INITIAL GRADES)
←→	OVERLAND RELEASE TO BAY/CHANNEL
↗	STORM WATER PUMP STATION AND DISCHARGE
+	LOW POINT
*	EXISTING CONDITION TO REMAIN (NO GRADING PROPOSED).
**	ELEVATIONS FOR FUTURE GRADING WITHIN UCSF CAMPUS PER UCSF GRADING PLANS. UCSF GRADING PLANS SHALL MEET PRESCRIBED OVERLAND FLOW BOUNDARIES. UCSF GRADING PLANS SHALL REFLECT SURCHARGE SETTLEMENT CONDITIONS.

GRADING NOTES:

1 A 30 FT. WIDE DRAINAGE SWALE SHALL BE GRADED ALONG THE NORTH SIDE OF SOUTH COMMON STREET FROM THIRD STREET TO TERRY FRANCOIS BOULEVARD. WHERE THE SWALE MEETS THIRD STREET, THE SWALE SHALL HAVE A FLOW LINE ELEVATION OF 98.4 FT., AND THE CURB ON THIRD STREET SHALL BE DEPRESSED TO 98.4 FT. FOR THE WIDTH OF THE SWALE. THE MIDPOINT CONNECTOR ROAD (BETWEEN THIRD STREET AND TERRY FRANCOIS BOULEVARD) SHALL BE DESIGNED SUCH THAT NO ELEVATION EXCEEDS 98.1 FT. AT ITS INTERSECTION WITH THE DRAINAGE SWALE. THE SWALE SHALL HAVE A FLOWLINE ELEVATION OF 98.0 FT. (EQUAL TO THE TOP OF CURB ELEVATION) WHERE IT MEETS TERRY FRANCOIS BOULEVARD.

② SIDEWALK CROSS-SLOPE SHALL BE 4%, TO INCREASE OVERLAND FLOW CAPACITY, AS FOLLOWS:

- A. BOTH SIDES OF THIRD STREET FROM MISSION ROCK STREET TO 100 FT. SOUTH OF SOUTH COMMON STREET.
- B. ON THE NORTH SIDE OF NORTH COMMON STREET FROM THIRD STREET TO TERRY FRANCOIS BOULEVARD.
- C. ON THE SOUTH SIDE OF SOUTH COMMON STREET FROM THIRD STREET TO TERRY FRANCOIS BOULEVARD.



NOTES:

- 1) ELEVATIONS SHOWN ARE INTENDED TO REPRESENT THE ADJACENT TOP OF CURB ELEVATIONS (LOW SIDE OF ASYMMETRICAL STREETS AND 4 CORNERS ON INTERSECTIONS). ELEVATIONS ARE INDICATED AT CENTERLINE FOR SIMPLICITY ONLY. ACTUAL CENTERLINE ELEVATIONS WILL VARY DEPENDING UPON DESIGN CROSS-SLOPE.
- 2) MINIMUM FIRST FLOOR ELEV. SHALL BE HIGHER THAN A 2% GRADIENT FROM SIDEWALK ELEV. BUT NOT LESS THAN 99.0.
- 3) THIS PLAN IS CONCEPTUAL, AND IS INTENDED FOR DISCUSSION PURPOSES ONLY.
- 4) ALL ELEVATIONS PER MISSION BAY DATUM.
100.000 FT. MISSION BAY DATUM = 0.000 FT.
SAN FRANCISCO CITY DATUM = 8.616 FT. MEAN SE

CONCEPTUAL GRADING PLAN

CATELLUS DEVELOPMENT CORPORATION

MISSION BAY PROJECT

CONCEPTUAL GRADING PLAN

Designed by DM/MM	JOB NO. 0441-008	Scale 1" = 200'
Drawn by JE	Sheet No. 1	Revision No. Date
Checked BH		
Cad File: 4418pf01	of 1 Sheets	
Date 12-1-00		

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SAN FRANCISCO, CALIFORNIA 94105



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DEVELOPMENT CORPORATION

LEGEND

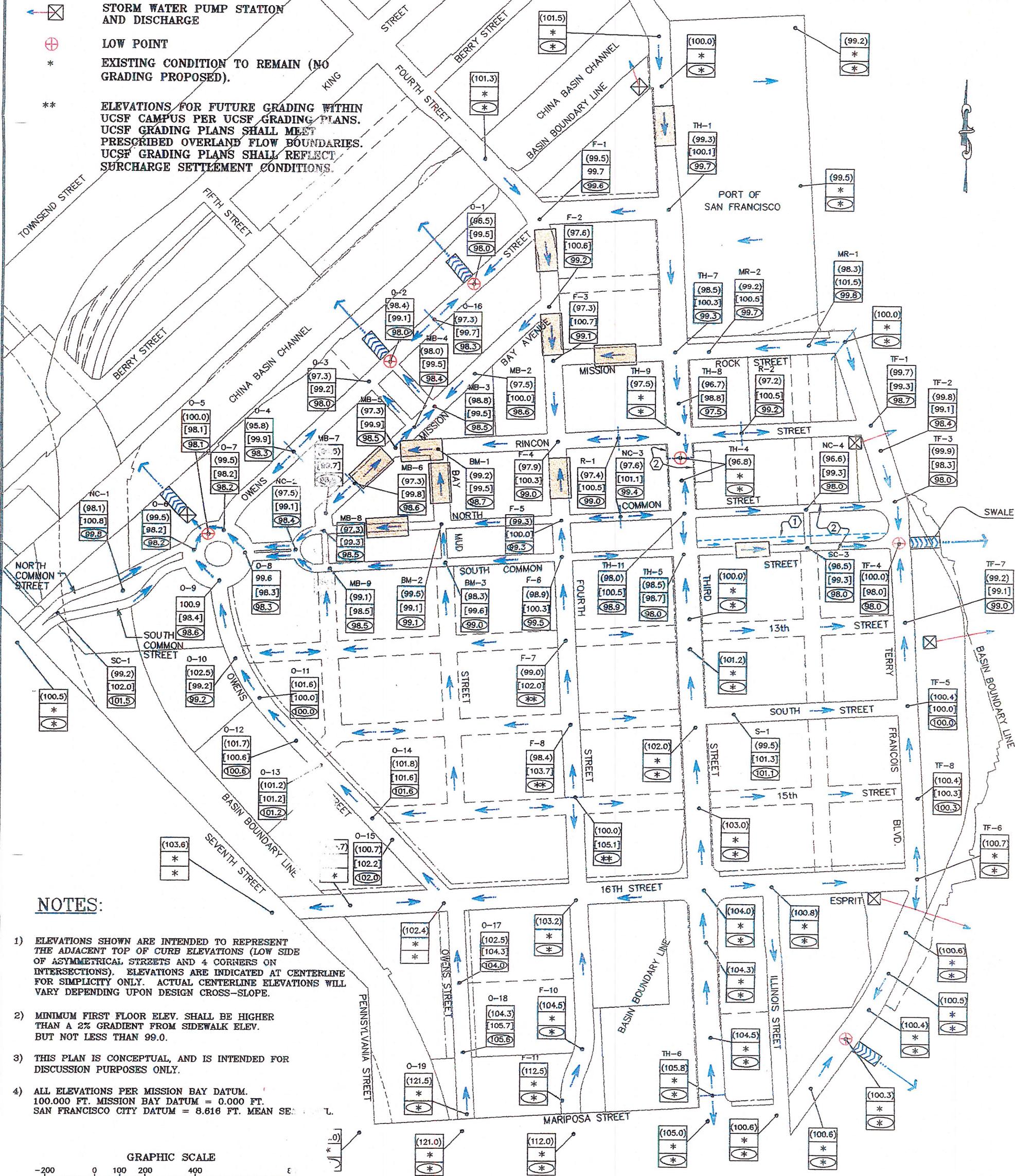
<u>SYMBOL</u>	<u>DESCRIPTION</u>
(xxx.x)	EXISTING ELEVATION
[xxx.x]	INITIAL ELEVATION
xxx.x	FINAL ELEVATION (POST 50 YEARS SETTLEMENT)
	FLOW DIRECTION BASED ON FINAL GRADES
	FLOW DIRECTION FOR FINAL GRADES. (FLOWS IN OPPOSITE DIRECTION BASED ON INITIAL GRADES)
	OVERLAND RELEASE TO BAY/CHANNEL
	STORM WATER PUMP STATION AND DISCHARGE
	LOW POINT
*	EXISTING CONDITION TO REMAIN (NO GRADING PROPOSED).
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CONCEPTUAL GRADING PLAN

Designed by DM/MM	JOB NO. 0441-008	Scale 1" = 200'
Drawn by JE	Sheet No. 1	Revision
Checked BH		No.
Cad File: 4418pf01		Date
Date 12.1.00		

CATELLUS DEVELOPMENT
CORPORATION

MISSION BAY PROJECT

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SANTINA & THOMPSON, INC.

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Hawk
Engineers, Inc.
594 HOWARD STREET - SUITE 202
SAN FRANCISCO, CALIFORNIA 94105

 CATELLUS
DEVELOPMENT CORPORATION

LEGEND

- (4) — WATERSHED DESIGNATION
 (C) - - - WATERSHED SUBAREA DESIGNATION

100.7 FINAL ELEVATION (50 YEAR SETTLEMENT)
 AS SHOWN ON GRADING PLAN DATED 4/26/00
 * NO GRADING PLANNED AT THESE LOCATIONS
 EXISTING GRADES SHOWN.

* * ELEVATIONS FOR FUTURE GRADING WITHIN
 UCSF CAMPUS PER UCSF GRADING PLANS

(+) LOW POINT

← → OVERLAND RELEASE

S=0.004 SLOPE

STREET FLOW SECTION

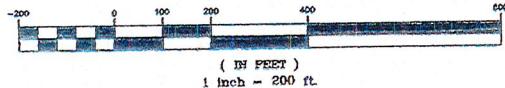
MAXIMUM PONDING PRIOR
 TO RELEASE

FLOW DIRECTION

OVERLAND FLOW
 FROM THE WEST
 RELEASED TO
 CHANNEL HERE.

ELEVATED FREEWAY
 DRAINED SEPARATELY
 BY CAL-TRANS. FREEWAY
 AREA NOT TRIBUTARY TO
 MISSION BAY WATERSHEDS.
 AREA'S INDICATED ARE NET.

GRAPHIC SCALE



OVERLAND FLOW – FINAL GRADES

Designed by MM	JOB NO. 0558	Scale AS SHOWN
Drawn by MB	Sheet No. 1	Revision No. Date
Checked MM		
Cad File: 5581PF01E	of 1 Sheets	
Date 12-1-00		

TELLUS DEVELOPMENT CORPORATION

MISSION BAY PROJECT

Sheet Title: WATERSHED MAP FOR OVERLAND FLOW
 based on
 FINAL (50 YR SETTLEMENT) GRADES

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