BERKELEY: OFFICE OF ENVIRONMENTAL HEALTH AND SAFETY
BUSINESS AND ADMINISTRATIVE SERVICES
2223 FULTON STREET

June 24, 1988

To: Strawberry Creek Committee Members
Re: Philip Williams & Assoc. Bank Stabilization Study / Erosion control.
From: Bob Charbonneau BC

PW&A recently completed their study on the central campus reaches of the creek. Two copies of their report were delivered, one each to Sonja and Bob C. A copy of the report text is enclosed. The extensive graphics are too cumbersome to reproduce. This study was designed as a component of the Strawberry Ck. Management Plan. A study by vegetation and wildlife specialists is recommended in order to develop a complete restoration/enhancement plan.

To summarize, urbanization in the watershed has both increased peak flows and shortened the lag time of concentration of these flows. This has resulted in downcutting and subsequent bank erosion and failure on the central campus. Existing rock check dams have been effective in preventing major channel incision. Many of these have deteriorated over time, resulting in significant bank failure (ie North Fork by University Hse.). Additional grade control structures are needed to stabilize the streambed. Low (1.0-1.5') rock check dams are recommended. These will also improve aquatic habitat. Vegetative bank stabilization is also recommended in areas where redwoods do not dominate the canopy.

The hydrology/hydraulics analysis gives estimated peak flows for different reaches of the creek (Table 1). Computer modelling also estimates peak velocities and water depths at numerous locations where cross-sections of the channel were measured (Table 2). Channel slopes of the North Fork are actually flatter than the South Fork because of the existing check dams that break the gradient, so generally less bank erosion has occurred in the North Fork.

PW&A provided conceptual solutions for erosion control along the creek. Long-term solutions lie in watershed management practices (stormwater management, development in the Canyon, etc.). Conceptual solutions for the creek include repairing and building low rock check dams, providing energy dissipation under some culverts, revegetating some banks, removing broken rubble, building a few grouted rock retaining walls, pouring new footings, properly tying check dams and walls into the banks, removing a few downed trees across the channels, and other miscellany. As an alternative to check dams it may be possible to stabilize short reaches by aligning/burying large rocks in the channel to create a natural pool-riffle sequence.

Erosion sites were prioritized on a scale of 1-4. We have submitted deferred maintenance requests for FY 1989-90 for this work. Top priority is stabilization of the North Fork downstream of University Hse by repairing and building rock check dams. Estimated cost is about $15000. Cost to repair 20 Priority 2 sites will be about $80,000. of which $32,000 will be for repair of a 100' undercut cement retaining wall by the electrical substation on the South Fork. Cost to repair 33 Priority 3 sites will be about $50,000, whereas the cost to repair 21 Priority 4 (lowest) sites will be about $30,000.

PW&A provided design solutions for erosion around Stephens Hall. This entails building a redwood cribwall upstream of Stephens Bridge to stabilize an eroding bank and bridge wingwall. Concrete channel bottom and an undercut cement wall will be removed in this reach. The channel will be widened slightly to relieve a constriction point and a grouted rock wall will be built to replace the cement wall. New footings will be poured under the steam duct overcrossing. Phase 2 requires the construction of 3-4 rock check dams to stabilize the streambed. Construction of the cribwall and steam duct overcrossing footings and wall will begin next week (June 28). The check dams will be built by CCC crews under the supervision of Bob C upon completion of the retaining and cribwalls.

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STRAWBERRY CREEK
BANK STABILIZATION STUDY
UNIVERSITY OF CALIFORNIA AT BERKELEY

by

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in association with

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under contract to

The Department of Facilities Management
University of California at Berkeley

June 1988

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ACKNOWLEDGEMENTS

This report was prepared by Philip Williams and Associates for the Department of Facilities Management, University of California at Berkeley.

The report was prepared by Jeffrey Haltiner, Principal. Other staff members who contributed are Larry Fishbain, John Morrison, Adele Shepherd, and Eve Kliszewski. Specific designs for the wooden cribwall and concrete retaining wall repair at the Stevens Hall site were conducted by Jack Schultz (J & S Mechanical Design) and Thomas Christian (Structural Engineer).

Sonja Biorn-Hansen, the University's representative, provided overall guidance and coordination for the project. Robert Charbonneau provided both project oversight and valuable technical assistance as a University representative.

I. INTRODUCTION

Strawberry Creek represents one of eight Berkeley creeks flowing between the Coast Range and San Francisco Bay. Both the South Fork and most of the North Fork of the Creek flow in open channels through the main campus. In the 2.4 miles between the Bay and the UC Berkeley campus, the Creek is mostly contained in culverts. In the campus reach, Strawberry Creek provides numerous benefits. In addition to its functional role of providing drainage and flood conveyance, it serves as valuable riparian and wildlife habitat, and provides for visual, educational, and recreational activities.

These values have declined over time as the creek has been neglected. Sewage discharges, building encroachment, alteration of the upstream watershed and channel/bank erosion have led to a gradual degradation of both water quality and the riparian corridor along the creek. Recognizing these problems, the University, through the Department of Facilities Management, has recently initiated both policy and technical actions to restore the creek. The Strawberry Creek Environmental Quality Committee was established to address the following issues (Charbonneau 1987):

- Review and evaluate all activities that impact the environmental quality of the creek.

- Develop a master plan for the improvement and maintenance of the environmental quality of the creek.

- Provide campus departments (EH&S, DOFM, Planning Office) with technical guidance and direction to minimize adverse environmental impacts on the creek.

- Review existing and pending state and federal water quality regulations.

- Review and evaluate environmental studies related to the creek.

In addition, the above-referenced work by Charbonneau presents a Management Plan for portions of Strawberry Creek within the University's jurisdiction. The plan includes recommendations which pertain both specifically to the Strawberry Creek channel/bank areas and which are also applicable to the entire watershed. Examples of creek recommendations include point source pollution control, channel stabilization, channel grade control, and aquatic and riparian habitat restoration. Watershed level management strategies include non-point source controls, stormwater management, and fire management.

The study results presented in this report represent one component of this overall management plan: an analysis of bank and channel erosion problems on the campus portions of the North and South Forks of Strawberry Creek. The specific scope of work for this project included the following tasks:

1. Prepare maps of the creeks at 20 scale (1 inch equals 20 feet). Include the location of existing bank/channel structures.

2. Survey the creek, measuring channel thalweg elevations and channel cross-sections at 200-foot intervals.

3. Identify locations where active bank or channel erosion is occurring.

4. Conduct a hydraulic analysis of channel flow depths and velocities for use in identifying critical erosion areas.

5. Provide conceptual solutions and guidelines for creek stabilization throughout the campus reaches of Strawberry Creek.

6. Provide specific solutions/biddable designs for the stabilization of the Stevens Hall steam pipe overcrossing and the Stevens Hall bridge areas.

The study is intended to provide baseline information on the existing erosion hazards, to identify the most critical problem areas, determine the cause of the problems, and suggest solution approaches. While the study is not intended to serve as a comprehensive riparian restoration/enhancement plan for the creek, it is our intent that the types of solution recommended be environmentally and aesthetically sensitive, restoring where possible the natural functioning of the creeks. However, a broader study, including vegetation and wildlife specialists, would be recommended to develop an overall restoration/enhancement plan.

As part of the planning process, the University has requested that our recommendations minimize removal of existing trees (both native and non-native), minimize disturbance of existing conditions (natural or man-made structures), and minimize costs of changes.

II. STUDY APPROACH

The study consisted of the following steps:

1. Topographic surveying of Strawberry Creek (North and South Forks).

2. Field determination of existing structures and bank/channel erosion problems.

3. Hydrologic analysis (estimation of peak flows from existing data).

4. Hydraulic analysis (routing of peak flows using open channel flow [HEC-2] computer model).

5. Map preparation showing hydraulic structures and problem locations.

6. Identification of conceptual solutions for North and South Fork problem areas.

7. Preparation of design level solutions for the Stevens Hall site.

The channel survey was conducted using existing campus benchmarks for reference elevations. Channel cross-sections were measured at approximately 200-foot intervals in each fork. Channel thalweg measurements were made at all significant changes in grade, at an average of 30-foot intervals.

The locations of all natural features and hydraulic structures are identified using standard surveying notation. Locations are denoted in feet upstream from the starting point as X + Y, where X represents hundreds of feet and Y represents feet. Thus, a structure at "10+50" on the South Fork would be 1,050 feet from the downstream starting point. For the Main and South Fork of Strawberry Creek, the invert of the Oxford Street Culvert on the west end of the campus is used as the downstream channel starting point (i.e., location 0+00). Stationing on the North Fork begins at its confluence with the South Fork. It is traditional in hydrology to identify left and right channel banks from the perspective of an observer looking downstream. Thus, for the east-to-west trending South Fork, the "left bank" refers to the south bank.

All of the Main/South Fork Channel (4,517 feet) and North Fork Channel (2,188) feet on the campus were visually inspected to assess bank/channel erosion problems. Scour under retaining walls and check dams was measured. In addition, each problem area was given a generalized severity rating from 1 to 4 to indicate the critical problem areas and to establish a ranking for future repair work. This rating is intended to highlight locations where erosion may cause major damage to channel or bank structures.

In an attempt to correlate hydraulic conditions in the creek with the location and severity of erosion problems, computer modeling of peak flows was conducted. Using existing hydrologic analyses, estimates were made of the 100-year peak flows throughout the creek system. These flows were then routed through the creek channels using a step-backwater computer model. The model provides estimates of flow depth and velocity at each of the surveyed cross-sections. Locations with high velocity were analyzed to determine their susceptibility to erosion problems. This data will also be useful to estimate hydraulic forces in the design of any new in-channel structures and for future flood studies. The locations of all structures, cross-sections, erosion problems, etc. are presented on a series of 20 scale (1 inch equals 20 feet) plan/profile maps. The plan view maps were prepared using existing maps available from the university. These maps are from 10 to 40 years old, and some modifications were necessary to update them. These maps were only used to show the creek locations. Since all channel elevations were resurveyed during our study, the topographic elevations shown on the maps were not used. There were a number of locations where field survey locations did not agree with map distances.

Once the location and source of erosion problems were identified, conceptual-level solutions were developed. Our approach is to recommend solutions which reproduce, as much as possible, the natural functioning of the creek. The design of environmentally sensitive solutions is a developing science. In the less severe problem areas, we recommend trying several alternative approaches and monitoring the results over a five- to ten-year period. The most successful solutions can then be applied more extensively.

In the Stevens Hall reach of Strawberry Creek, erosion problems are particularly severe and warrant immediate correction. The steam pipe overcrossing has been severely undermined, while the upstream end of the Stevens Hall bridge is being eroded. Design-level solutions were prepared to solve these specific problems.

Throughout the study, we have attempted to integrate our work with the recommendations of the Strawberry Creek Management Plan (Charbonneau 1987). It would be useful to expand this erosion control study with a complete riparian restoration plan for the creek at some future time. We have designed our conceptual and detailed solutions to improve aquatic habitat while providing erosion control. We believe our recommendations can be directly integrated with any future biologic restoration work on the creek.

TABLE 1

SUMMARY OF ESTIMATED 100-YEAR PEAK FLOWS IN STRAWBERRY CREEK

Site	Location	Drainage Area (Acres)	Q_{100} (cfs)
I. North Fork			
Hearst Ave. Culvert	21+88	296	360
Cross-Campus Culvert	11+78	369	430
Junction with S. Fork	0+00	388	440
II. South Fork			
Little-Inch Culvert	45+17	92	145
Big-Inch Culvert	40+10	699	535
Junction with N. Fork	6+23	759	585
III. Main Fork			
Oxford St. Culvert	0+00	1,163	874

TABLE 2:

SUMMARY OF HYDRAULIC RESULTS FROM THE HEC-2 MODEL FOR THE 100-YEAR FLOW

Location	Cross-Section Number	Slope	Velocity (fps)	Depth (feet)
SOUTH FORK				
50	1.4	0.000129	1.72	13.61
1+90	2.0	0.001775	3.89	9.18
3+35	3.0	0.005477	5.94	6.65
6+15	4.0	0.002317	4.39	6.63
7+25	5.0	0.017003	7.80	6.08
9+05	6.0	0.003828	4.50	7.02
9+90	7.0	0.008964	5.52	4.07
12+10	8.0	0.000066	0.93	14.93
13+60	9.0	0.000573	1.97	7.87
15+20	10.0	0.001223	2.07	7.96
16+40	11.0	0.029090	8.52	5.21
17+85	12.0	0.027235	8.52	4.95
19+45	13.0	0.032052	11.39	5.40
21+45	14.0	0.000137	1.59	12.32
24+45	15.0	0.018315	8.18	3.67
24+95	16.0	0.018214	8.91	4.45
	17	Bypass - Low Flow - Not Calculated		
27+60	18.0	0.001866	4.31	8.53
28+70	19.0	0.013226	7.24	7.91
29+35	20.0	0.009274	5.20	7.76
30+30	21.0	0.002588	4.23	8.07

Location	Cross-Section Number	Slope	Velocity (fps)	Depth (feet)
<u>SOUTH FORK</u> (cont'd.)				
31+15	22.0	0.033782	10.63	7.13
33+20	23.0	0.000415	2.07	10.66
33+50	24.0	0.001714	3.12	7.72
35+85	25.0	0.022361	9.11	3.99
36+50	26.0	0.024942	9.83	4.53
39+05	27.0	0.000410	1.50	6.11
41+00	28.0	0.000542	1.61	5.58
41+25	29.0	0.029931	6.14	2.05
44+05	30.0	0.000012	0.28	13.20
<u>NORTH FORK</u>				
40	31.0	0.026337	8.33	2.76
6+60	32.0	0.014919	6.72	4.76
7+70	33.0	0.000278	1.78	11.85
9+60	34.0	0.000312	1.68	7.54
13+55	35.0	0.211640	8.56	4.52
15+70	36.0	0.003415	3.99	6.69
18+70	37.0	0.037025	10.15	6.00
21+10	38.0	0.001503	2.53	10.32

with a relatively uniform channel slope of 2 to 3 percent (cf. the channel between 0+00 and 11+50) and other reaches with a "stairstep" appearance (channels with very little slope connected by sharp drops at the check dams, cf. section 19+50 to 29+50). The hydraulic model predicts significant velocity differences between these channel reaches, with velocities of 7-10 fps (feet per second) in the steeper reaches, and velocities of 2-4 fps in the flatter portions.

On the North Fork, the average channel slope is slightly steeper, dropping 79 feet over a channel distance of 2,200 feet, with an average slope of 3.6 percent. 37 of the 79 vertical drop (representing 47 percent) is currently accounted for by check-dam drops. Prior to the failure of the two major check dams at locations 19+39 and 20+38, an additional 8 feet were accounted for by check dams. As a result, the actual channel slopes are flatter and the velocities generally less than those on the South Fork. This is likely the reason that there are proportionally fewer locations on the North Fork experiencing severe bank erosion from high-velocity flows.

C. Bank/Channel Erosion Problems

The detailed location and nature of bank/channel erosion sites are shown on the attached tables, photographs, and site maps. The following general types of problems were observed:

1. <u>Check Dams</u>

a. Undercutting of the downstream face resulting from inadequate scour protection and excessively large vertical drop.

b. Erosion around the sides of the check dams (and occasionally complete end cutting) where they are inadequately tied into the banks.

c. Partial or total deterioration of structures resulting from inadequately sized rock and gradual erosion of the mortar.

Because of the importance of preventing channel incision, the existing 50 check dams were examined in detail. For each check dam, the location, channel drop, and condition were assessed. Channel drop represents the difference in elevation between the upstream channel invert and that downstream of the structure. It does not represent the depth of the scour hole beneath the structure. Structure condition was rated on a scale of 1 to 4, where: (1) structure stable; (2) minor erosion damage; (3) major erosion damage; and (4) structure deteriorated. For those structures in condition (4), no channel drop was measured.

The results are shown in Table 3 and summarized in Table 4. Based on Table 4, it can be seen that all structures stabilizing a drop less than 1.0 ft. were stable, while those stabilizing a drop greater than 2.0 ft. were almost all unstable. Structures between 1.0 and 2.0 ft. had a 50 percent stability rate. 11

TABLE 3

CHECK DAM INFORMATION

Location	Channel Drop (ft.)	Status[1]
I. SOUTH FORK		
1+49		4
1+79		4
4+23		4
4+69		4
5+50		4
7+07		4
7+29		4
7+79	2.0	3
8+19		4
9+45		4
10+07	0.4	1
12+34	2.9	2
13+79		4
15+34		4
19+46	1.1	1
19+77	1.1	1
20+29	2.5	3
20+69	1.1	2
21+27	1.5	2
21+70	1.5	2
22+39	3.2	3

Location	Channel Drop (ft.)	Status[1]
I. SOUTH FORK (cont'd)		
24+25	4.4	3
28+16	1.0	1
30+40	0.7	1
34+81	1.7	1
35+70	1.6	2
40+18	3.0 (approx)	3
40+86	1.3	1
42+03	1.2	1
II. NORTH FORK		
0+27	4.5	3
1+00	1.0 (approx)	1
6+44	3.0	3
8+15	1.8	2
9+40	1.1	2
10+68	0.5	1
11+46	1.0	1
12+13	2.2	3
12+79	1.7	1
13+12	2.7	2
13+54	1.5	2
14+38	0.7	1
15+39	2.8	3
16+26	2.5	3
16+71	2.9	3

Location	Channel Drop (ft.)	Status[1]
II. NORTH FORK (cont'd)		
17+41	4.8	1
18+09	1.2	1
18+16	0.7	1
19+39	4.0 (approx)	3
20+38	4.0 (approx)	3
21+77	0.5	1

1. Status is described as:

   1. Stable
   2. Minor erosion damage
   3. Severe erosion damage
   4. Deteriorated (remnant)

TABLE 4

SUMMARY OF CHECK DAM DATA

Grade Changes (ft.)	Status			
	1 (Stable)	2 (Minor Erosion)	3 (Severe Erosion)	4 (Deteriorated)
0.0 - 1.0	9	0	0	
1.0 - 1.5	5	4	0	
1.5 - 2.0	2	2	1	
2.0 - 2.5	0	0	3	
2.5+	1	2	9	
Indeterminate				11
TOTALS:	17	8	13	11

structures (all in the lower 2,000 feet of the South Fork) were completely deteriorated. There were no apparent differences in check dam stability between the North and South Forks. In most instances, structures were failing or damaged by severe undercutting of the downstream face.

2. Retaining Walls

   a. Undercutting of the foundation because of channel deepening.

   b. Erosion of the upstream or downstream end resulting from inadequate tie-in to the banks.

3. Natural Bank

   a. Erosion at the outside of meander bends.

   b. Bank failure in response to channel incision.

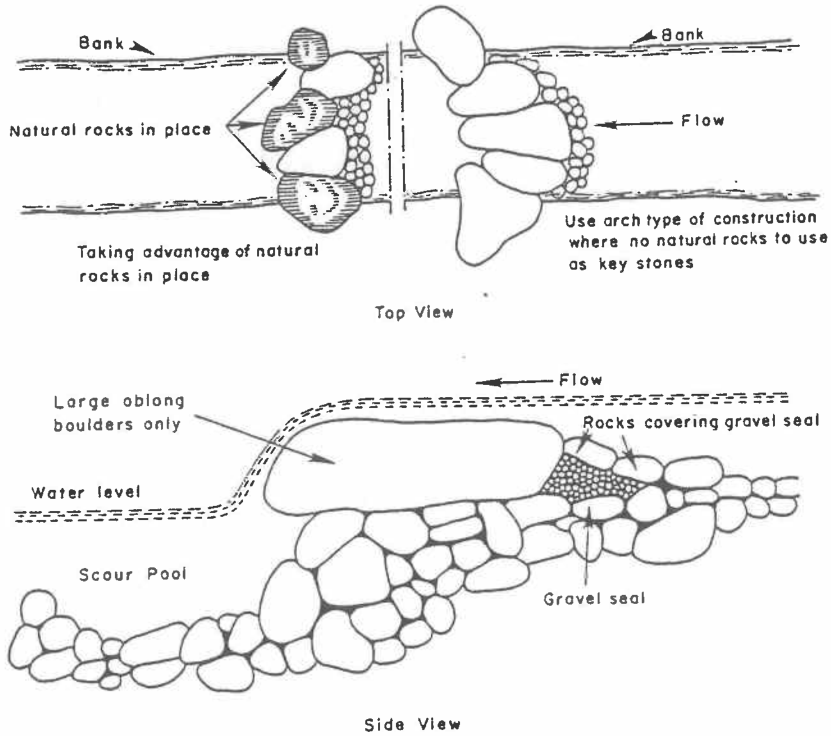
4. Storm Sewer Outlets

   a. Scour hole at base due to lack of energy dissipation.

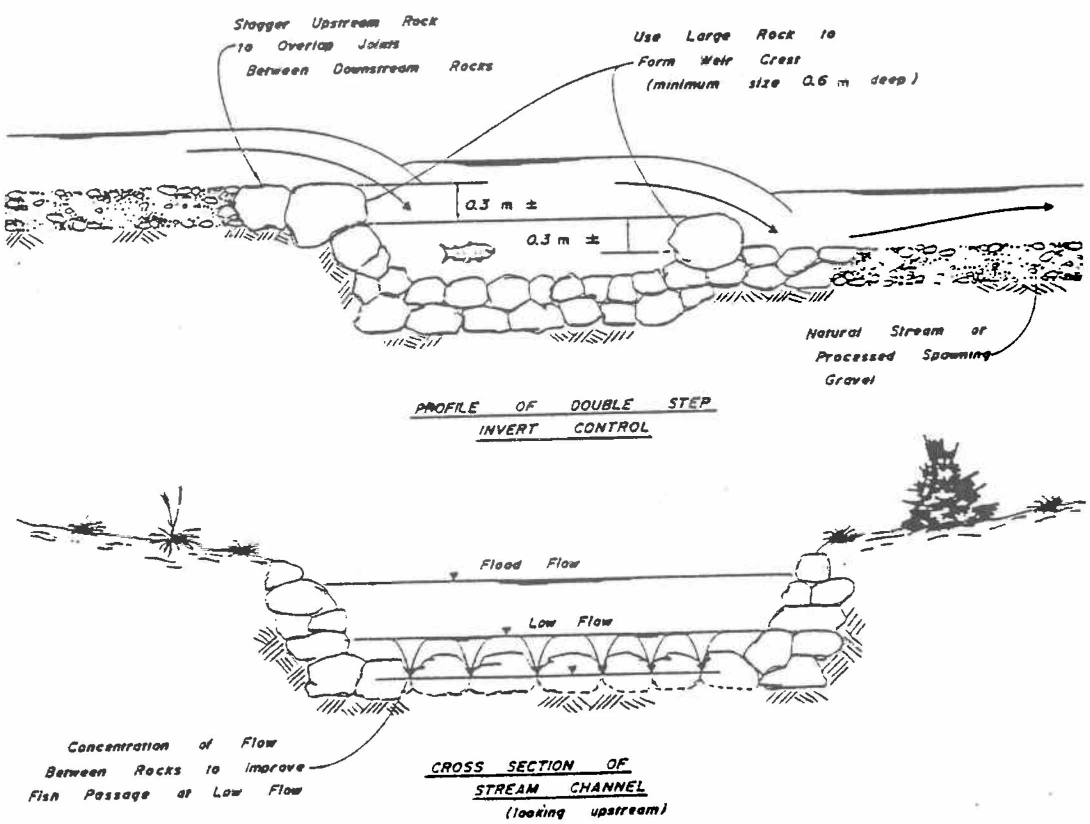
5. Concrete Channel Bottom

   a. Erosion resulting from undercutting at downstream end.

   b. Scour holes and subsequent failure during high-velocity flows.

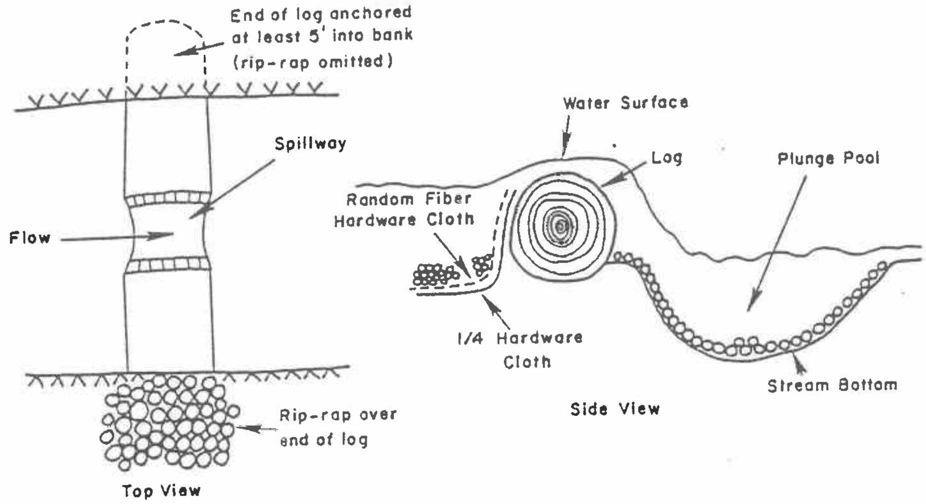


Boulder dams.

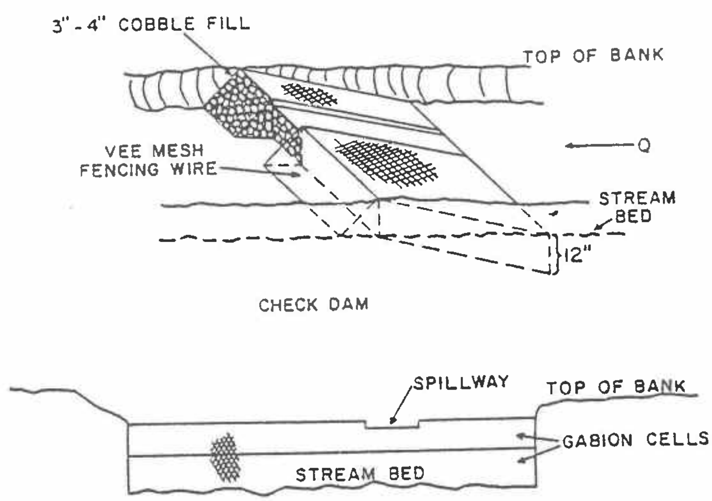


Rock used to control grade in a channel and minimize the downstream movement of gravel. Abutments must be protected with rip-rap to prevent the stream from washing around the ends of the rock weir.

Philip Williams & Associates Consultants in Hydrology	SCHEMATIC DESIGN OF ROCK CHECK DAMS (from Gore, 1985)	FIGURE 1a



Single log dam.



Design of gabion check dam.

Philip Williams & Associates Consultants in Hydrology	SCHEMATIC DESIGN OF LOG AND GABION CHECK DAMS (from Gore, 1985)	FIGURE 1b

concrete, reducing channel flow velocities. In those instances where a reinforced wall is necessary, a concrete wall can be faced with rock.

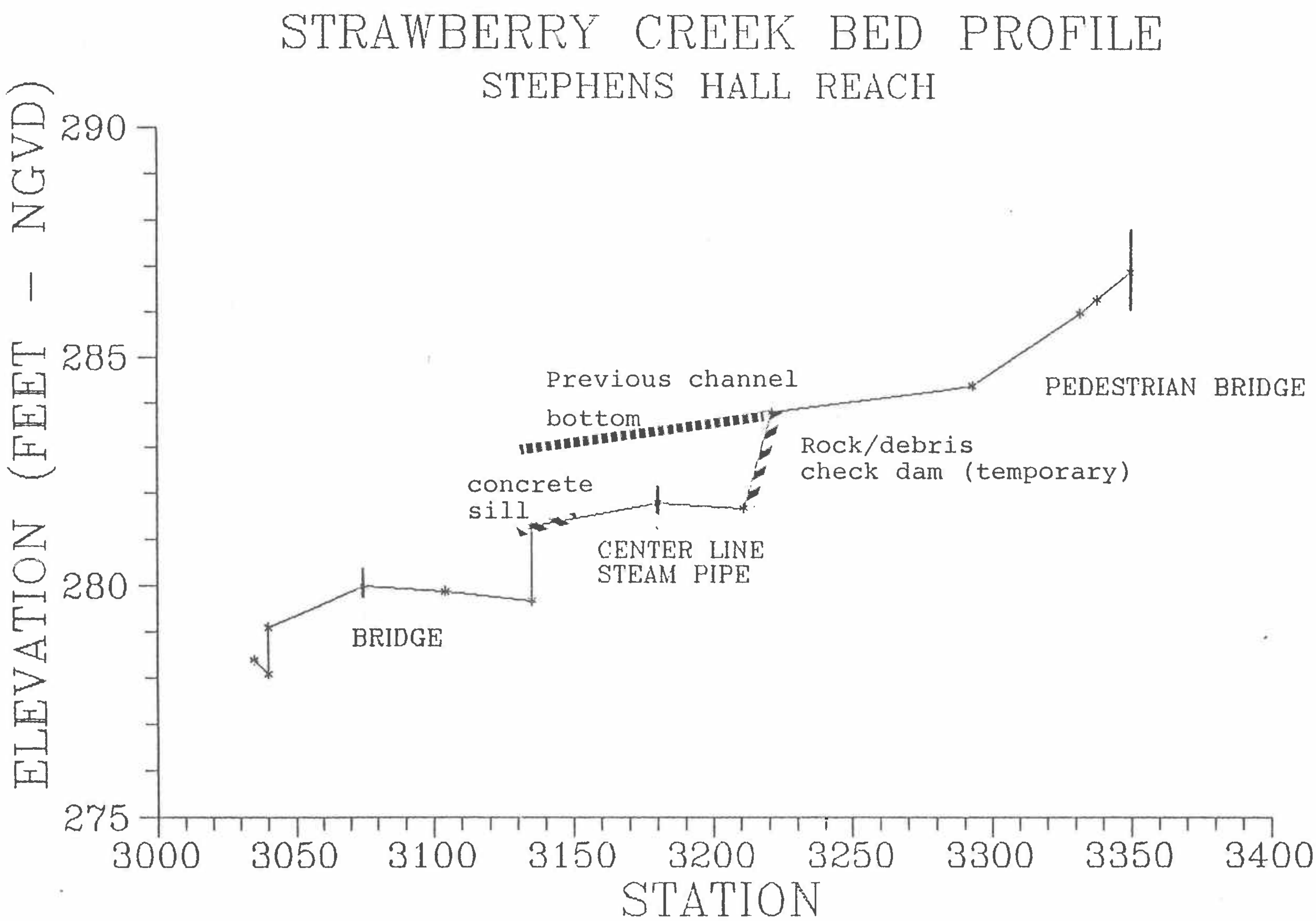
E. <u>Stevens Hall Site: Recommended Erosion Protection</u>

The channel reach of the South Fork adjacent to Stevens Hall combined the most serious erosion problems. These included extensive undercutting of the retaining walls supporting the steam pipe overcrossing, and severe bank erosion at the upstream end of the Stevens Hall bridge. Because of their severity, design-level solutions were prepared for these areas. Reduced versions of the design drawings are attached. They include underpinning of the walls, reconstruction of retaining walls, and the construction of a wooden crib retaining wall along the left bank.

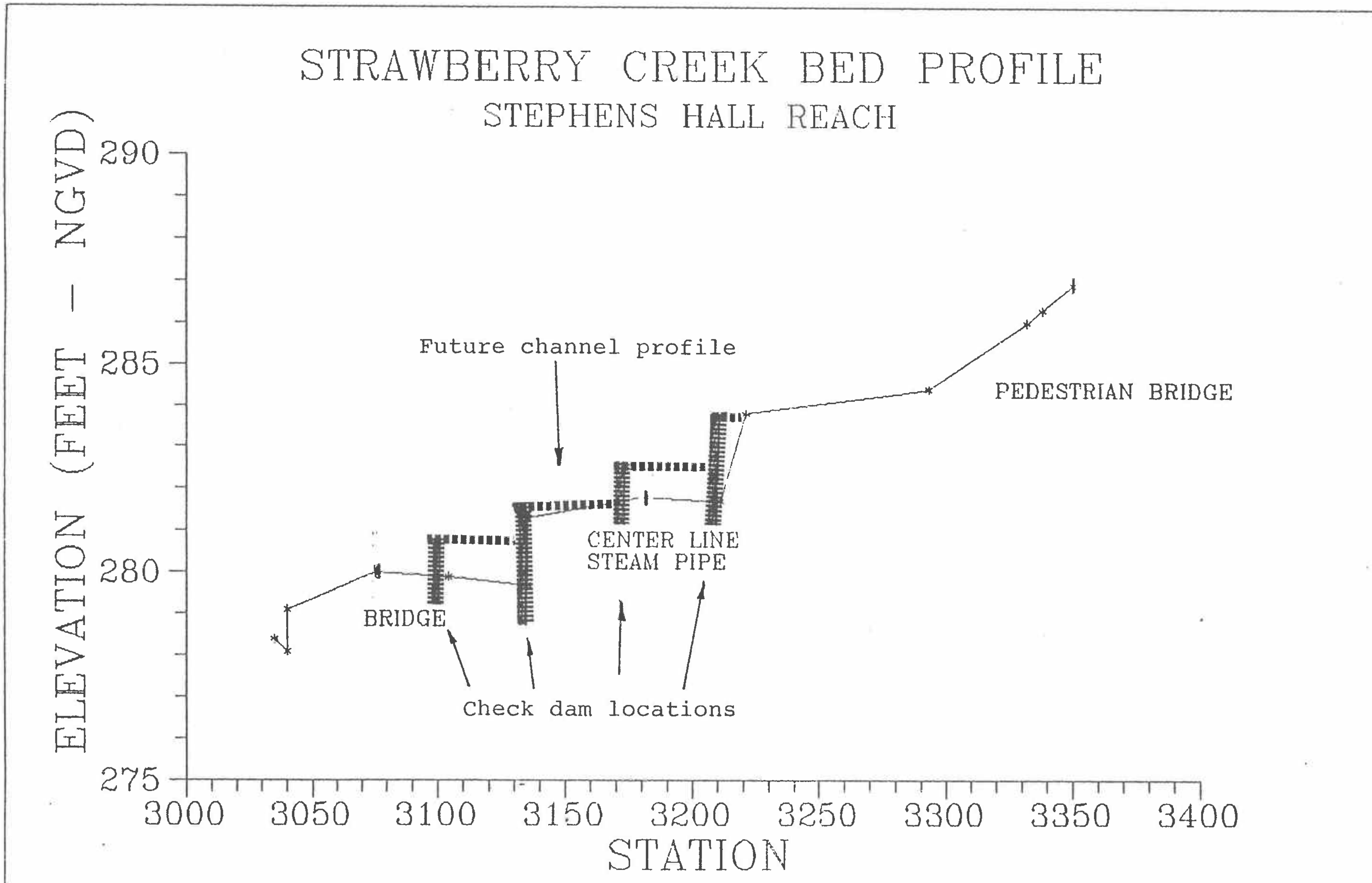
These problems resulted from channel incision and downcutting of 1 to 3 feet in this reach. Figure 2 is a profile of the creek channel bottom through the proposed work area (from the Stevens Hall Bridge upstream under the steampipe to the next pedestrian bridge 300 feet upstream). It can be seen that the channel rises in two "steps" going upstream, each about 1.5 to 2.0 feet high. The lower step is currently stabilized by the remnant piece of concrete channel bottom, while the upstream one is maintained by some large rocks and debris. Neither of these are permanently stable. It is also apparent that the channel bottom through this reach was several feet higher when the existing retaining walls were built. While the proposed design will stabilize the walls, the problem could recur if future channel downcutting occurs.

Therefore, as a Phase II recommendation, it is essential that additional channel stabilization be provided in this reach once the retaining walls are repaired and the crib wall is in place. We recommend construction of a series of three or four small check dams through this reach as shown on Figure 3. Each of these would stabilize a drop of about one foot. They should be keyed into the banks and bed to prevent undercutting, and provided with a scour pool which provides both energy dissipation and aquatic habitat. As part of the recommended Phase 1 work, the existing temporary check dam can be reconstructed at the same location (about 3210) using the large boulders which are currently in the channel near this location. These could quite easily be incorporated into a permanent check dam at this location.

While we consider the above work a Phase II project, it could be done by the same contractor immediately after the Phase I work is completed. This would minimize the disturbance to the surrounding area and might reduce set-up costs.

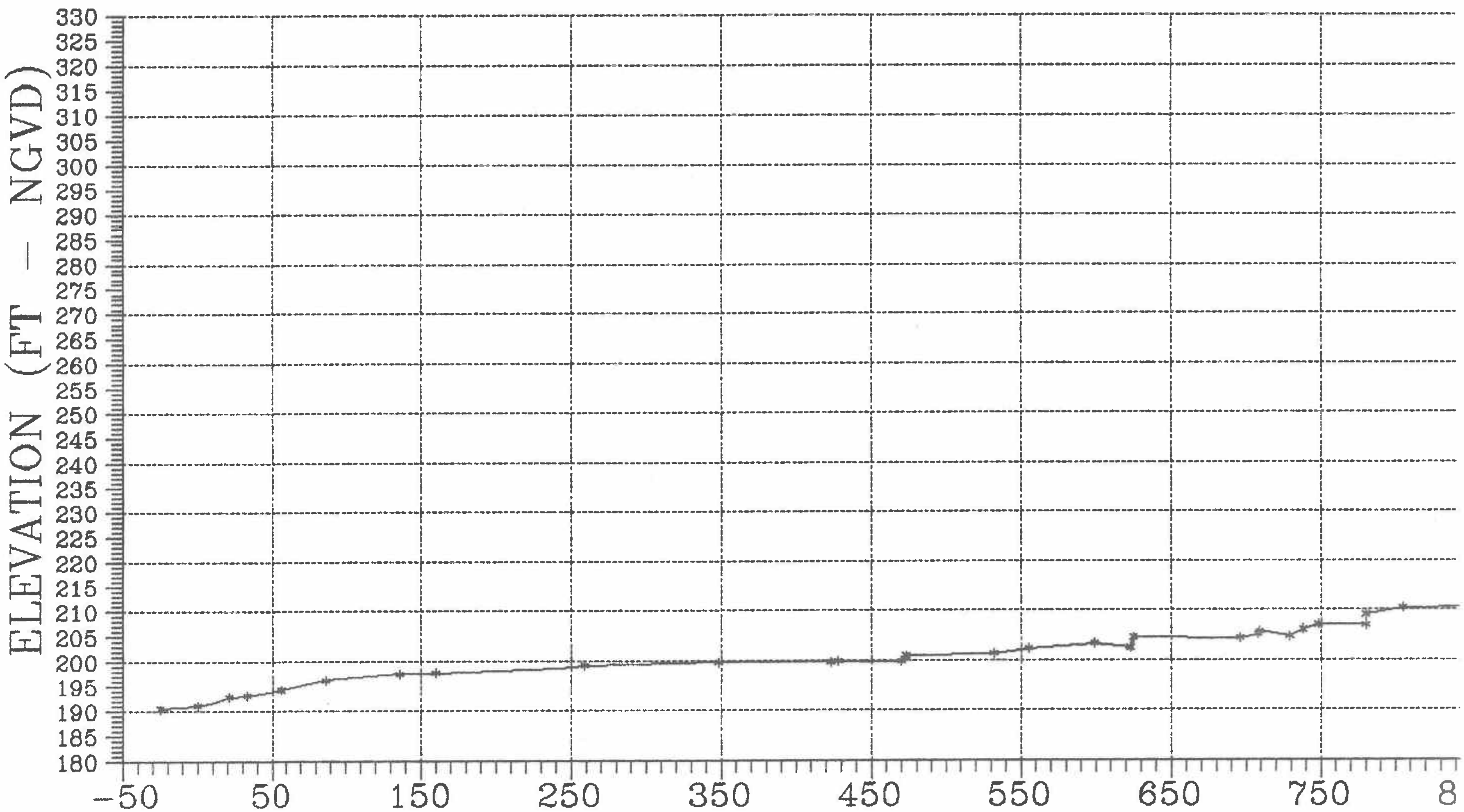


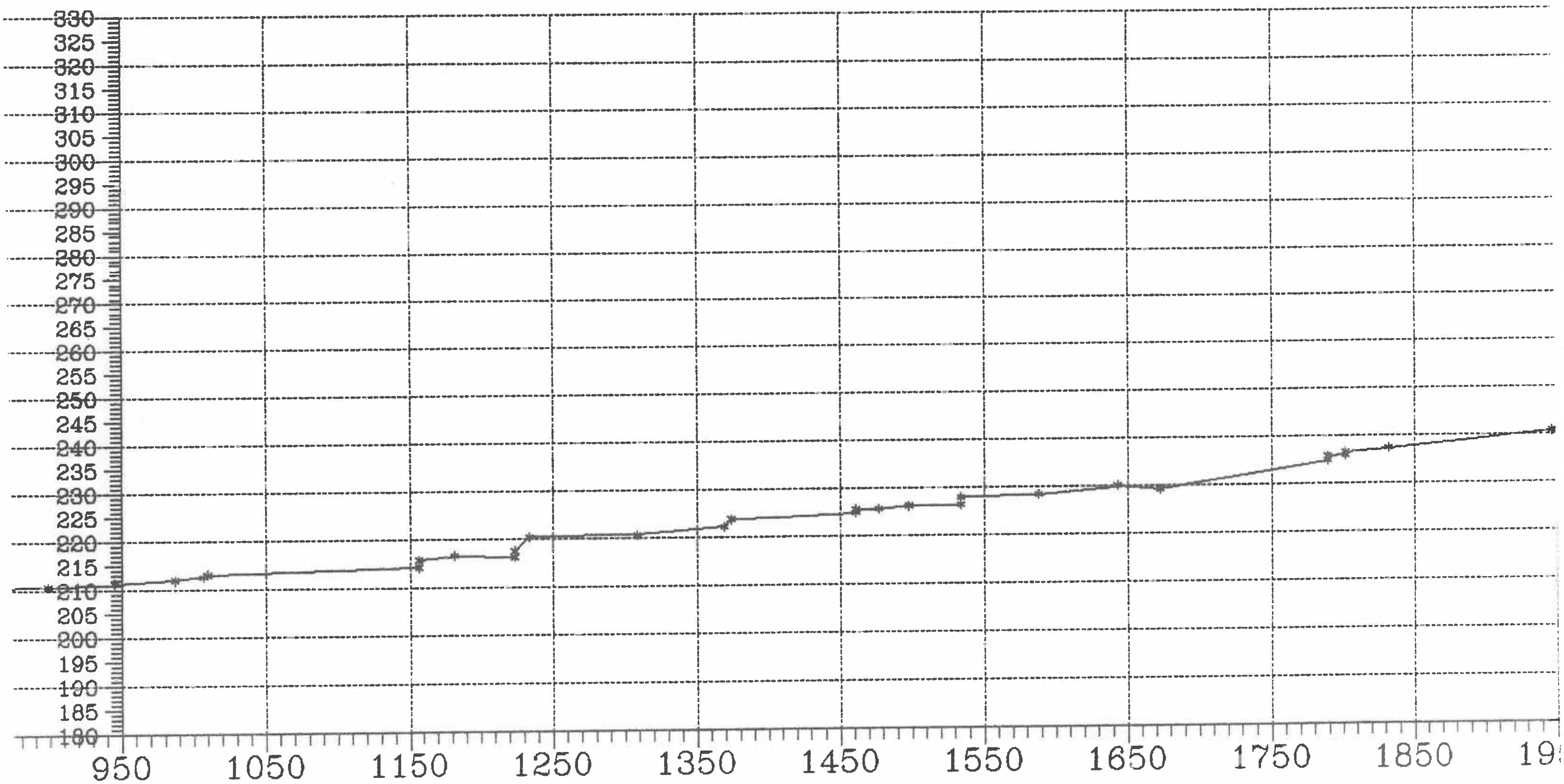
DATE: 05/12/88 BY: L. FISHBAIN	Existing channel profile	Philip Williams & Associates Pier 35, The Embarcadero San Francisco, California 94111	FIG. 2



DATE: 05/12/88 BY: L. FISHBAIN	Proposed check dam locations	Philip Williams & Associates Pier 35, The Embarcadero San Francisco, California 94111	Fig. 3

STRAWBERRY CREEK PROFILE - SOUTH FORK

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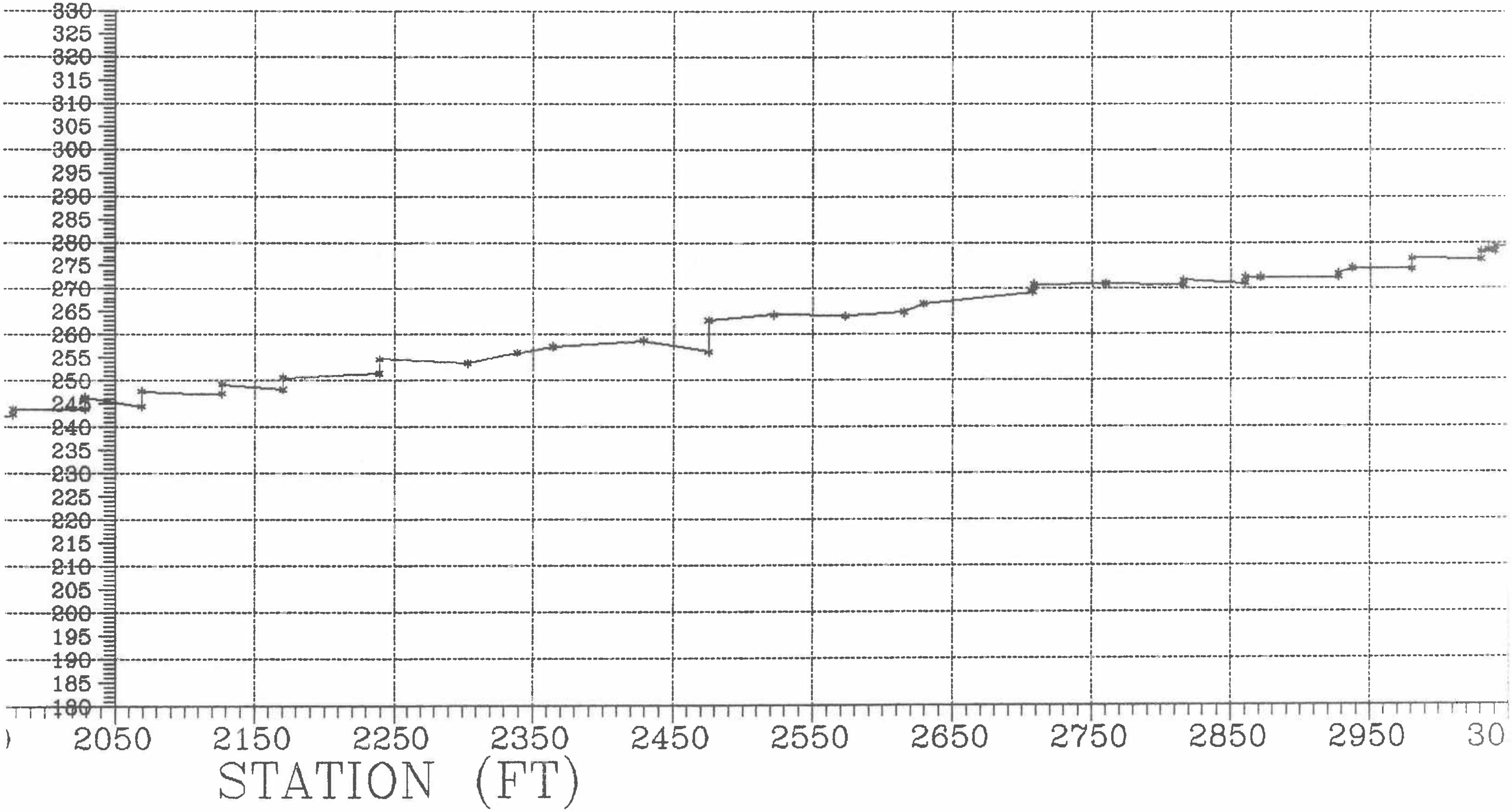
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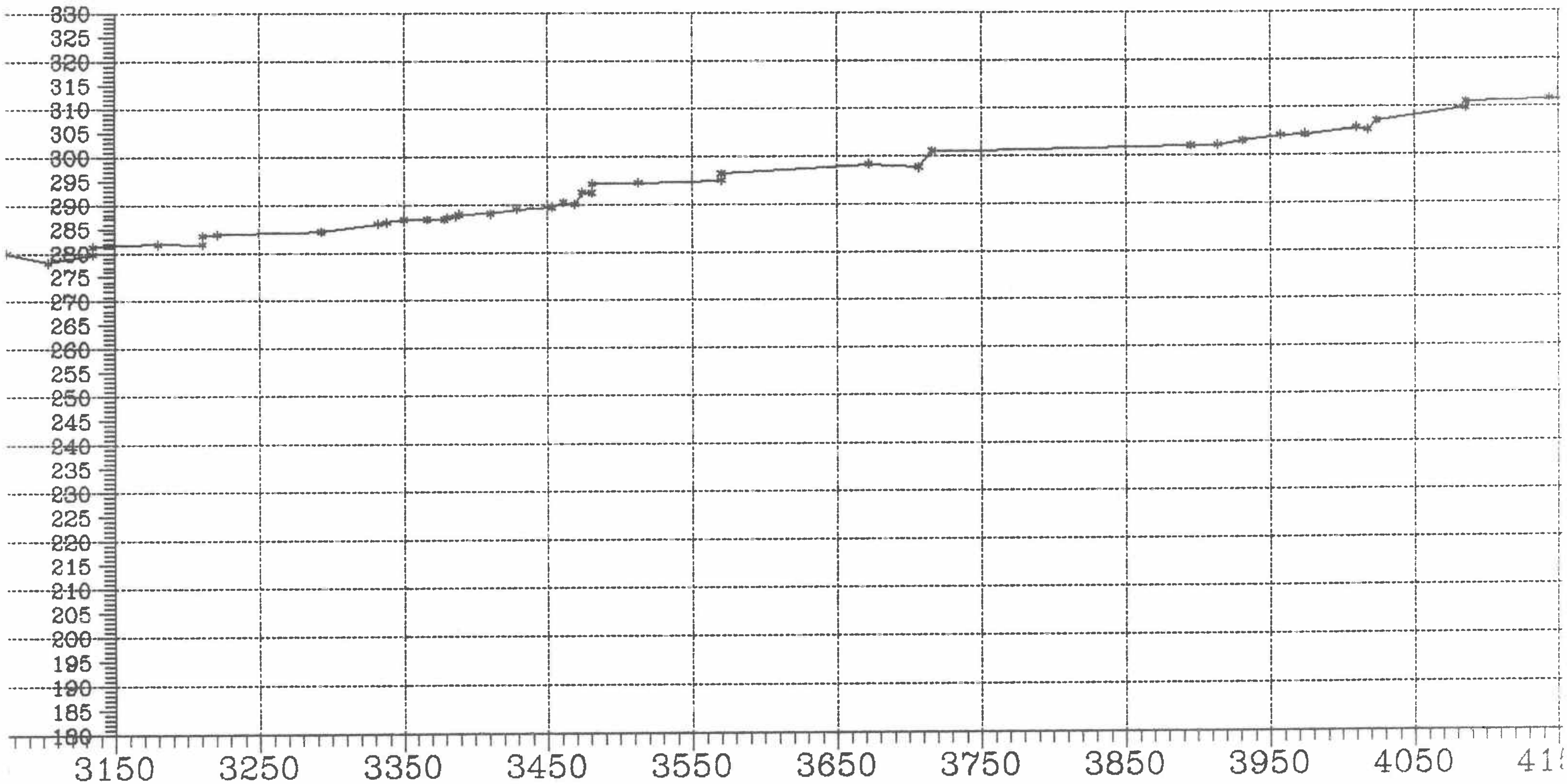
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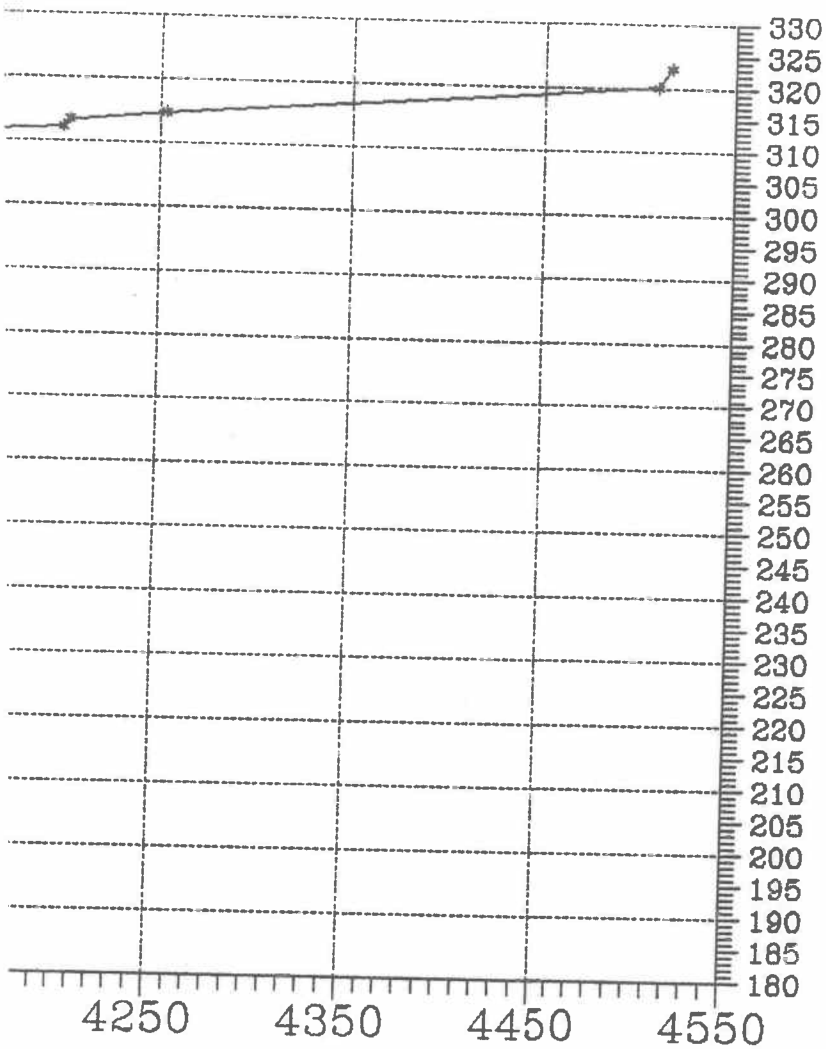
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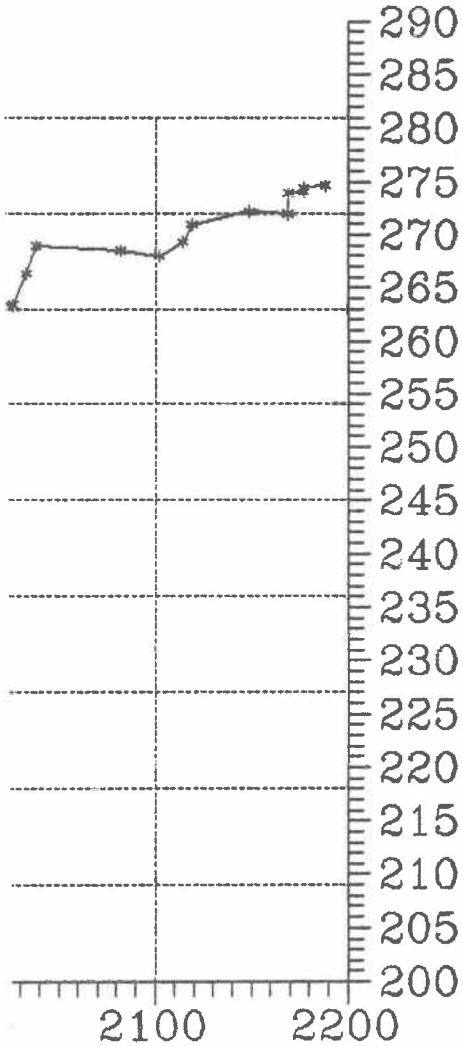
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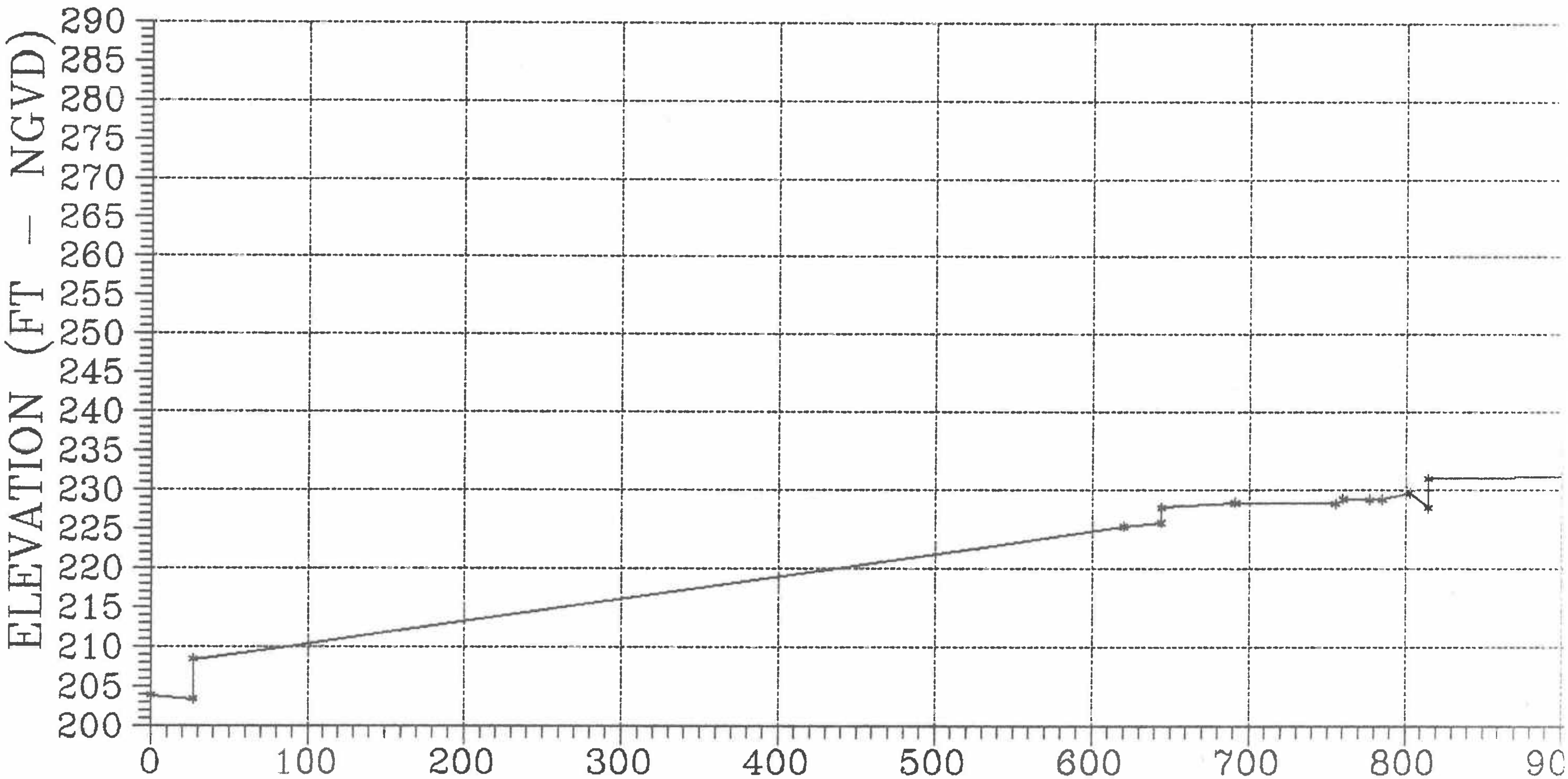
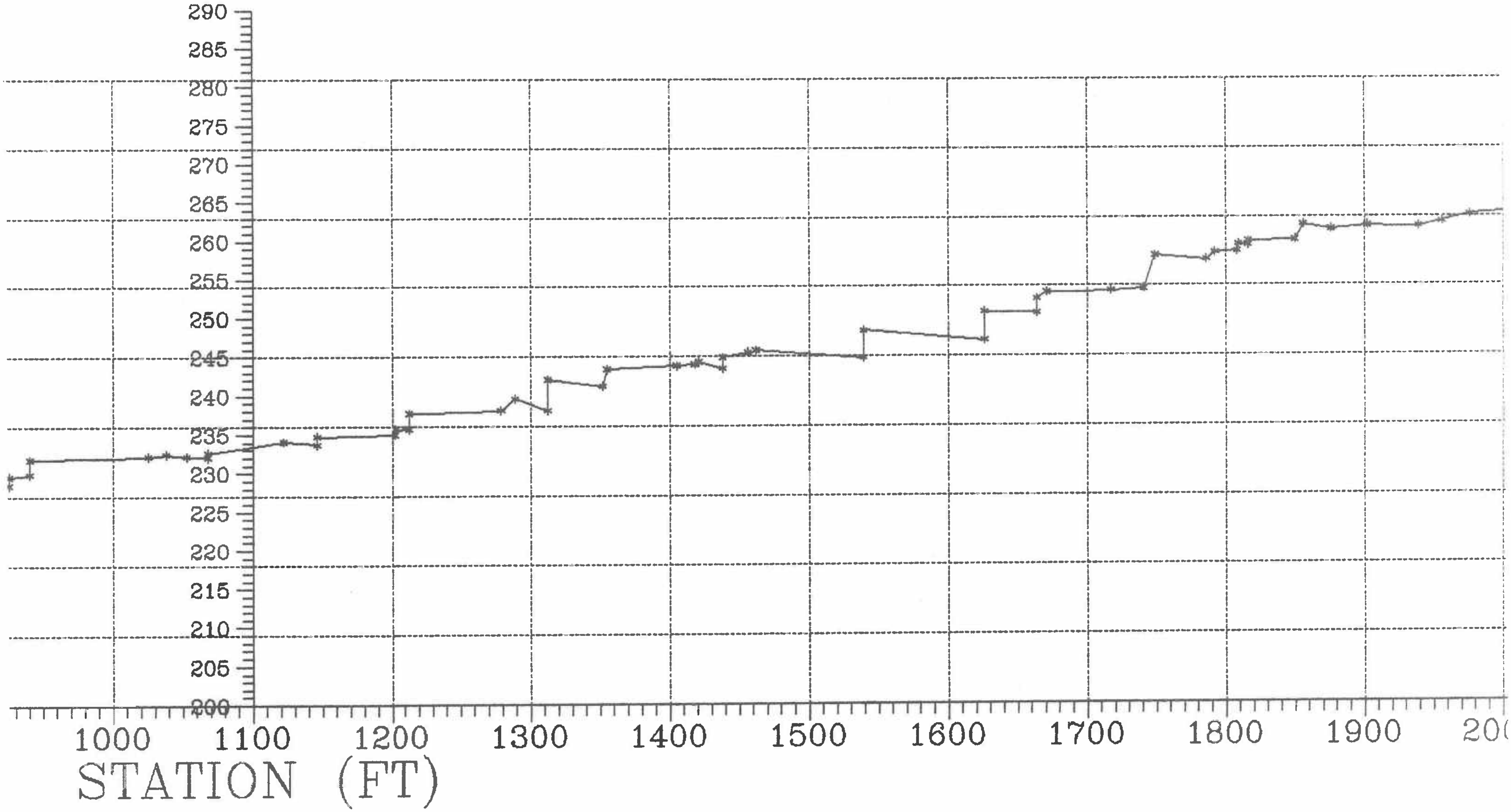
STRAWBERRY CREEK PROFILE - NORTH FORK

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1100
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1600
1700
1800
1900
STATION (FT)

Specifications
STRAWBERRY CREEK RESTORATION
University of California, Berkeley
Department of Facilities Management

[illegible]/[illegible] Bridge Streambank Protection

I. DESCRIPTION

A. The work shall consist of replacing approximately 42 feet of the damaged rock wall on the left bank of Strawberry Creek upstream of Stephen/Moses Bridge with a concrete footing and curb, and redwood log cribbing for streambank protection. The log cribbing shall be backfilled with gabion-sized rock and compacted backfill — separated by geotextile fabric.

Where practical, the terraces between log tiers shall be left void, for topsoil placed by others at the direction of the Landscape Architect. Footings shall be repaired at each end of the new curb as necessary and faired in with mortared-in-place rocks.

Approximately 13' of rock wall upstream and 10' of concrete and rock wall downstream are to be removed. The 6" drain line from the southeast catch basin is to be relocated as shown.

B. The Contractor shall perform all grading, excavation, stream diversion or other dewatering, log cribbing placement, and backfill necessary for complete, craftsmanlike performance of the work specified on the Drawings. This will include removal of all spoil and debris, and leaving the site ready for finish landscaping by others. Contractor shall be responsible for replacing turf to previous condition.

C. The excavation specified may encounter underground utilities — especially water lines to the fire hydrant, and power lines to the light standard at the southeast corner of the job site. Contractor shall excavate with care and expose any utilities encountered by hand digging and shall request instruction and coordination from Facilities Management before excavating further. Removal of the existing irrigation system, trees, and shrubbery will be performed by others before the work under this Contract commences.

D. Contractor's equipment will access the site over University Roads, and will work on and near the asphalt walk just north of the job site and upon the adjacent turf. Any damage to the walk or roads or unnecessary damage to turf outside the job excavation perimeter will be repaired at his or her expense. All gabion rock, gravel, and backfill material is to be stored on plywood lawn protection and contained as necessary to protect surrounding areas.

E. The log cribbing will be a "[illegible]" structure, although rustic in nature. The lines, grades, breaks, laps, and [illegible] shall be performed in a craftsmanlike manner, leaving no unnecessary scars or bark removal. It is expected that the work will be performed largely with chain saws and adzes, using [illegible] redwood logs with natural tapers and size variations, so that precise joints and dimensions are not expected, but rather uniform curves, lines and spacing. The location of crib log joints, timber ties, and timber anchors will be verified and adjusted in the field as necessary for structural integrity, for existing tree roots and underground utilities, and for a pleasing appearance.

The exact location of the upper two tiers of log cribbing may be modified under the direction of the Landscape Architect for conformance with future plans.

II. PRODUCTS

A. Concrete Curb —
3,000 PSI concrete, #5 reinforcing rod, #3 dowels and [illegible] geotextile fabric, and 1" PVC [illegible] drain per Caltrans "[illegible] Plans" and "Standard Specifications".

B. Backfill —
Gabion-sized rock [illegible] to [illegible] diameter, 3/4" drain rock as Caltrans. The rock is to be large enough so as to [illegible] washed out through the cribbing slits by flood water. The [illegible] rock will fill the rock voids to [illegible] topsoil [illegible] others.

C. Drift Pins —
Drift pins shall be 3/4" diameter smooth steel [illegible] to [illegible] wood. Drift pins are not to be galvanized.

D. Redwood Logs —
Logs are to be 12" minimum diameter of heartwood. Variations [in] heartwood diameters will be permitted to the extent that no [more] than 20% of the total footage may be undersize by 2".

III. EXECUTION

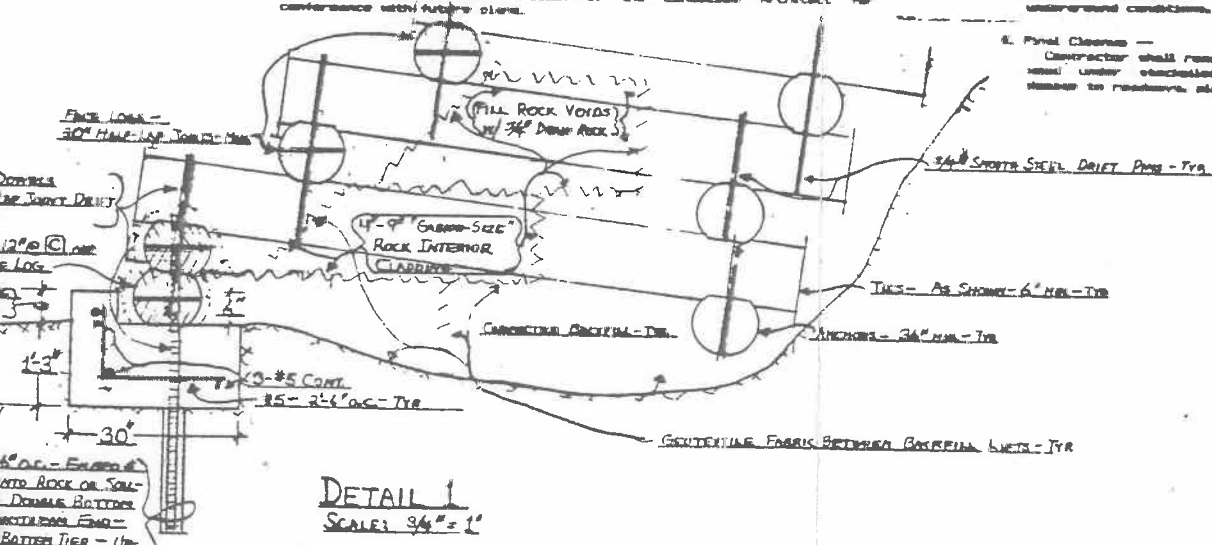
A. Concrete Footing and Curb —
The footing and curb may be curved, rather than in three straight segments as shown. Curb shall be [illegible] to the rock wall [illegible] existing concrete as appropriate. Footing and new footing [illegible] existing concrete shall be anchored to stream bottom with [illegible] dowels.

B. Log Cribbing —
1. Face logs shall be connected with half-lapped [illegible] joints. Elevation control shall be at log centers. Log ties and [illegible] shall be alternated to maintain reasonable uniformity.
2. Timber ties shall be 10' minimum length for the bottom [illegible] tiers, decreasing to 6' minimum at top. Spacers shall be sorted as necessary to maintain tiers horizontal.
3. Anchors shall be connected approximately 12" from the ends of the ties and shall be a minimum length of 36".
4. All joints between face logs, ties, spacers, and anchors [illegible] be notched for a minimum contact area of 4" by 4" of heartwood. All drift pins shall be driven so as to pass through the [illegible] wood contact area. (Drift pin pilot holes shall be drilled [illegible] with no oversized holes permitted.) (Note that plans [illegible] ally omit the "[illegible]" and bark for clarity — showing [illegible] heartwood.)

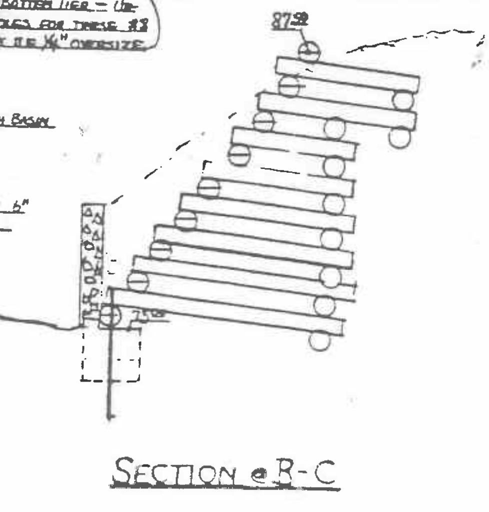
C. Backfill —
Gabion rock and compacted backfill shall be generally placed in lifts with geotextile fabric separation as shown. Leave as [illegible] space between the face logs as possible for topsoil and planting [by] others.

D. Layout Assistance —
The University will provide two working days' assistance by [illegible] Engineer during the initial stages of the work in order to [illegible] layout or sequence of log tiers and anchors, to accommodate [illegible] underground conditions, etc.

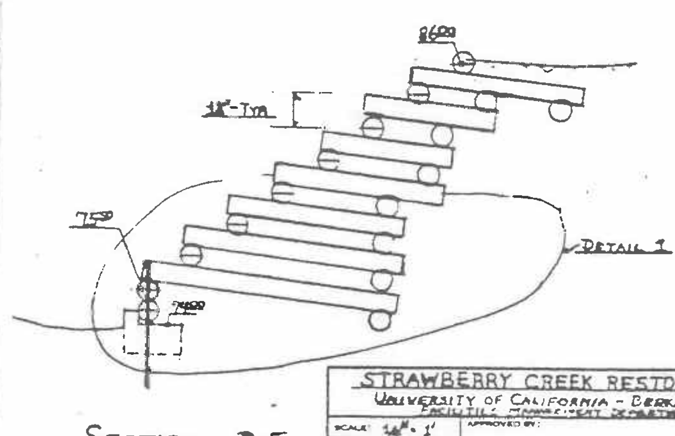
E. Final Cleanup —
Contractor shall remove all spoil, construction debris, and [illegible] under stockpiles, and leave site neat after repairing any damage to roadways, plantings and turf.



DETAIL 1
SCALE: 3/4" = 1'

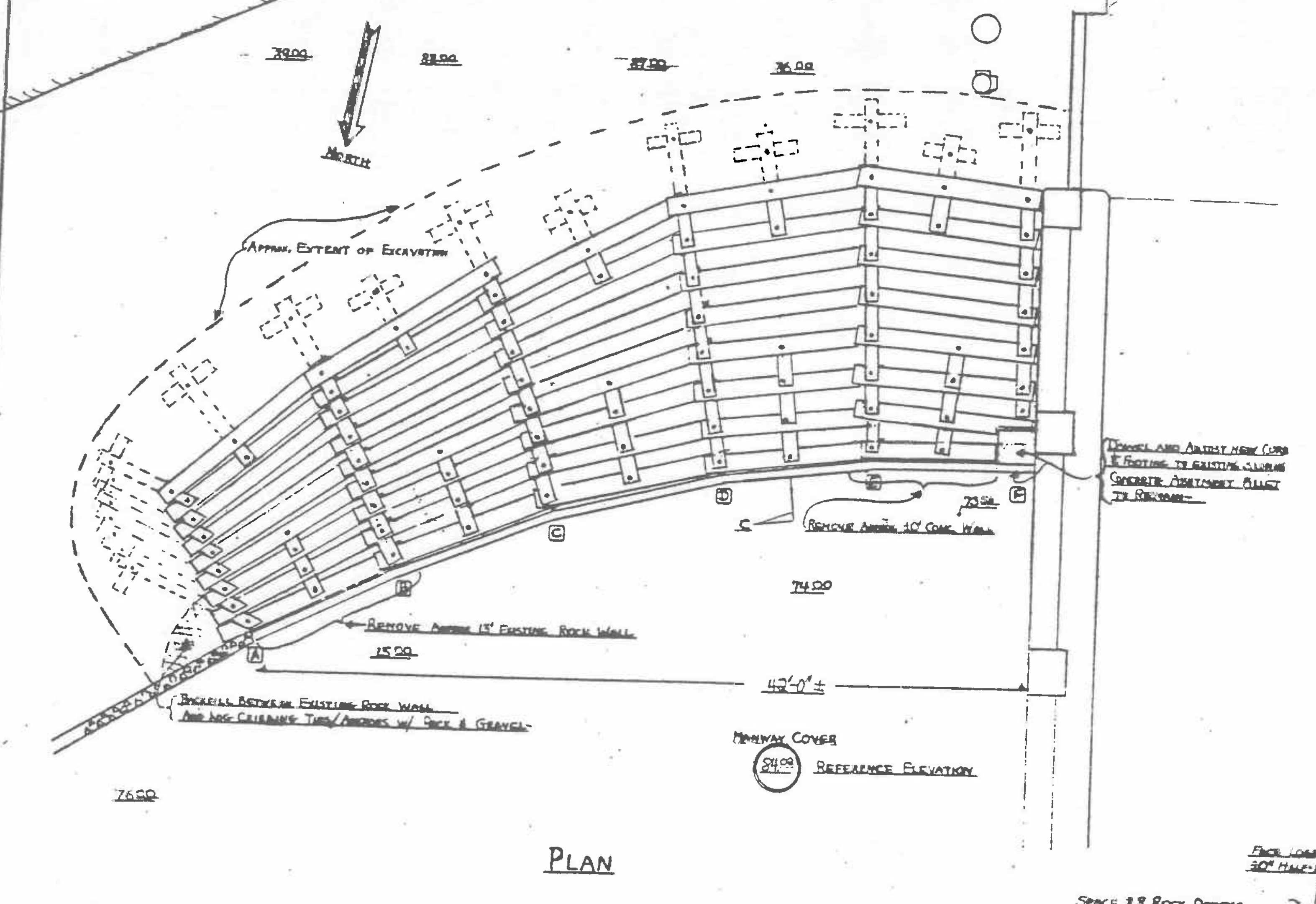


SECTION @ B-C



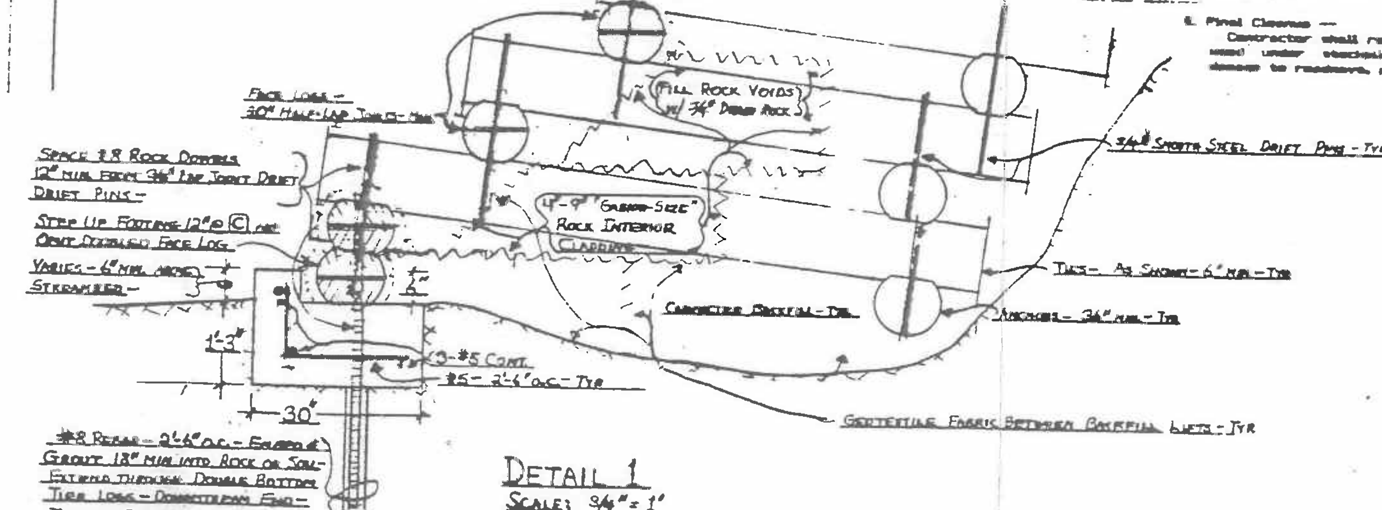
SECTION @ D-E

STRAWBERRY CREEK RESTORATION	
UNIVERSITY OF CALIFORNIA - BERKELEY	
SCALE: 1/4" = 1'	APPROVED BY:
DATE: 5/10/88	DRAWN BY / REVISED 5/
REDWOOD LOG STREAMBANK PROTECTION	
STEPHEN/MOSES BRIDGE SITE	
CONSULTING HYDROLOGIST: PHILIP WILLIAMS & ASSOC.	DESIGN: / DRAWING NO. 1 OF

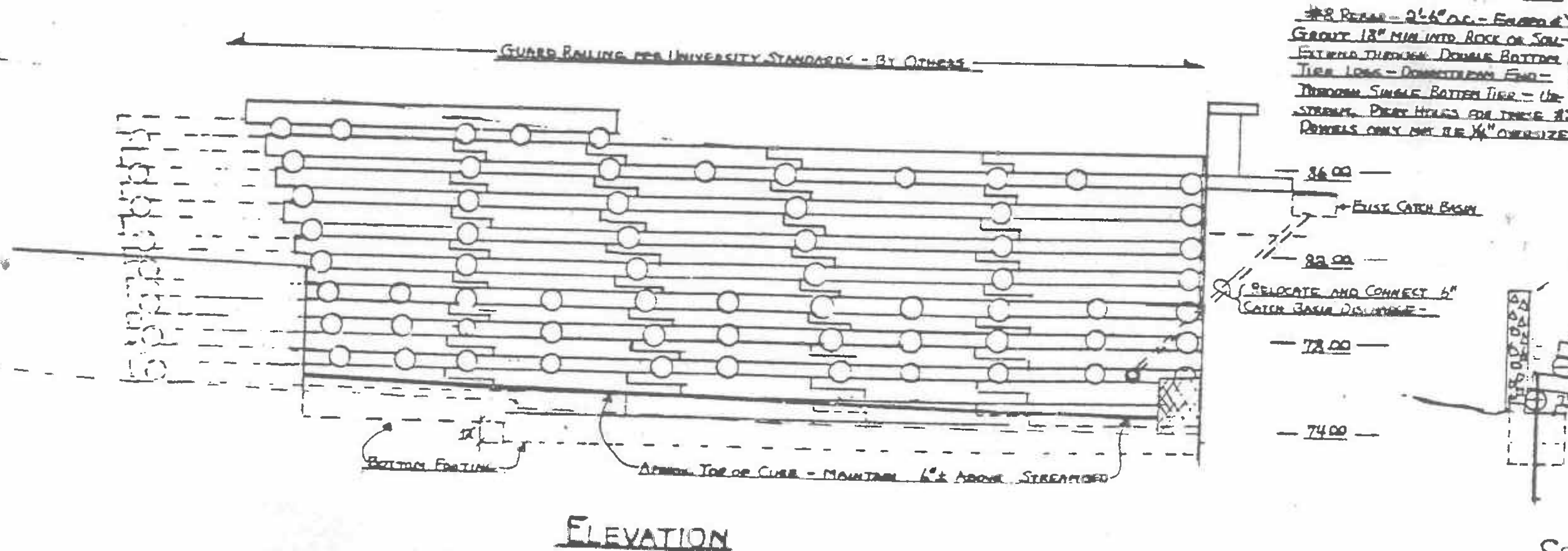


PLAN

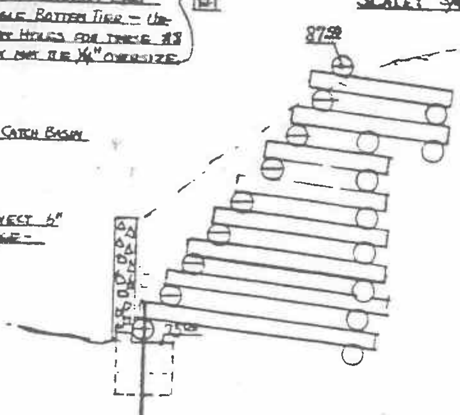
NOTE: ALL ELEVATIONS & DIMENSIONS APPROXIMATE – VERIFY ON SITE



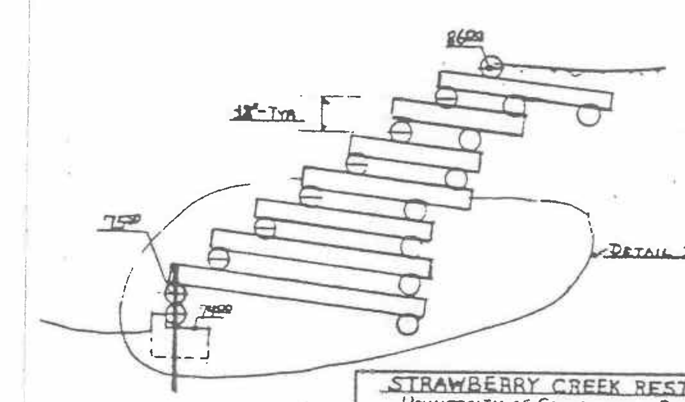
DETAIL 1
SCALE: 3/4" = 1'



ELEVATION



SECTION @ B-C



SECTION @ D-E

Specifications
STRAWBERRY CREEK RESTORATION
University of California, Berkeley
Department of Facilities Management

Stephens/Moses Bridge Streambank Protection

I. DESCRIPTION

A. The work shall consist of replacing approximately 42 feet of the damaged rock wall on the left bank of Strawberry Creek upstream of Stephens/Moses Bridge with a concrete footing and curb, and redwood log cribbing for streambank protection. The log cribbing shall be backfilled with gabion-sized rock and compacted backfill — separated by geotextile fabric.

Where practical, the terraces between log tiers shall be left void, for topsoil placed by others at the direction of the Landscape Architect. Footings shall be [illegible] at each end of the new curb as necessary and faired in with mortared-in-place rocks.

Approximately 13' of rock wall upstream and 10' of concrete and rock wall downstream are to be removed. The 6" drain line from the southeast catch basin is to be relocated as shown.

B. The Contractor shall perform all grading, excavation, stream diversion or other dewatering, log cribbing placement, and backfill necessary for complete, craftsmanlike performance of the work specified on the Drawing. This will include removal of all spoil and debris, and leaving the site ready for finish landscaping by others. Contractor shall be responsible for replacing turf to previous condition.

C. The excavation specified may encounter underground utilities — especially water lines to the fire hydrant, and power lines to the light standard at the southwest corner of the job site. Contractor shall excavate with care and expose any utilities encountered by hand digging and shall request instruction and coordination from Facilities Management before excavating further. Removal of the existing irrigation system, trees, and shrubbery will be performed by others before the work under this Contract commences.

D. Contractor's equipment will access the site over University Roads, and will work on and near the asphalt walk just north of the job site and upon the adjacent turf. Any damage to the walk or roads or unnecessary damage to turf outside the job excavation perimeter will be repaired at his or her expense. All gabion rock, gravel, and backfill material is to be stored on plywood lawn protection and contained as necessary to protect surrounding areas.

E. The log cribbing will be a "[illegible]" structure, although rustic in nature. The lines, grades, breaks, laps, and steel pinning shall be performed in a craftsmanlike manner, leaving no unnecessary scars or bark removal. It is expected that the work will be performed largely with chain saws and adzes, using unpeeled redwood logs with natural tapers and size variations, so that precise joints and dimensions are not expected, but rather uniform curves, lines and spacing. The location of crib log joints, timber ties, and timber anchors will be verified and adjusted in the field as necessary for structural integrity, for avoiding tree roots and underground utilities, and for a pleasing appearance.

The exact location of the upper two tiers of log cribbing may be modified under the direction of the Landscape Architect for conformance with future plans.

II. PRODUCTS

A. Concrete Curb —
3,000 PSI concrete, #8 reinforcing rod, #5 dowels and [illegible] geotextile fabric, and 1" PVC [illegible] drain per Caltrans "[illegible] Plans" and "Standard Specifications".

B. Backfill —
Gabion-sized rock 4" to 9" diameter, 3/4" drain rock as Caltrans. The rock is to be large enough so as to resist [illegible] washed out through the cribbing slits by flood water. The [illegible] rock will fill the rock voids to permit topsoil replacement by others.

C. Drift Pins —
Drift pins shall be 3/4" diameter smooth steel [illegible] to [illegible] used. Drift pins are not to be galvanized.

D. Redwood Logs —
Logs are to be 12" minimum diameter of heartwood. Variations in heartwood diameters will be permitted to the extent that no more than 20% of the total footage may be undersize by 2".

III. EXECUTION

A. Concrete Footing and Curb —
The footing and curb may be curved, rather than in three straight segments as shown. Curb shall be doweled to the rock wall [illegible] existing concrete as appropriate. Footing and new footing [illegible] existing concrete shall be anchored to stream bottom with [illegible] dowels.

B. Log Cribbing —
1. Face logs shall be connected with half-lapped joints [illegible] Elevation control shall be at log centers. Log ties and [illegible] shall be alternated to maintain reasonable uniformity.
2. Timber ties shall be 10' minimum length for the bottom [illegible] tiers, decreasing to 6' minimum at top. Spacers shall be sorted as necessary to maintain tiers horizontal.
3. Anchors shall be connected approximately 12" from the ends of the ties and shall be a minimum length of 36".
4. All joints between face logs, ties, spacers, and anchors [illegible] be notched for a minimum contact area of 4" by 4" of heartwood. All drift pins shall be driven so as to pass through the [illegible] wood contact area. Drift pin pilot holes shall be drilled [illegible] (with no oversized holes permitted). (Note that plans [illegible] ally omit the "[illegible]" and bark for clarity — showing [illegible] heartwood.)

C. Backfill —
Gabion rock and compacted backfill shall be generally placed in lifts with geotextile fabric separation as shown. Leave as [illegible] space between the face logs as possible for topsoil and planting by others.

D. Layout Assistance —
The University will provide two working days' assistance by [illegible] Engineer during the initial stages of the work in order to [illegible] layout or sequence of log tiers and anchors, to accommodate [illegible] underground conditions, etc.

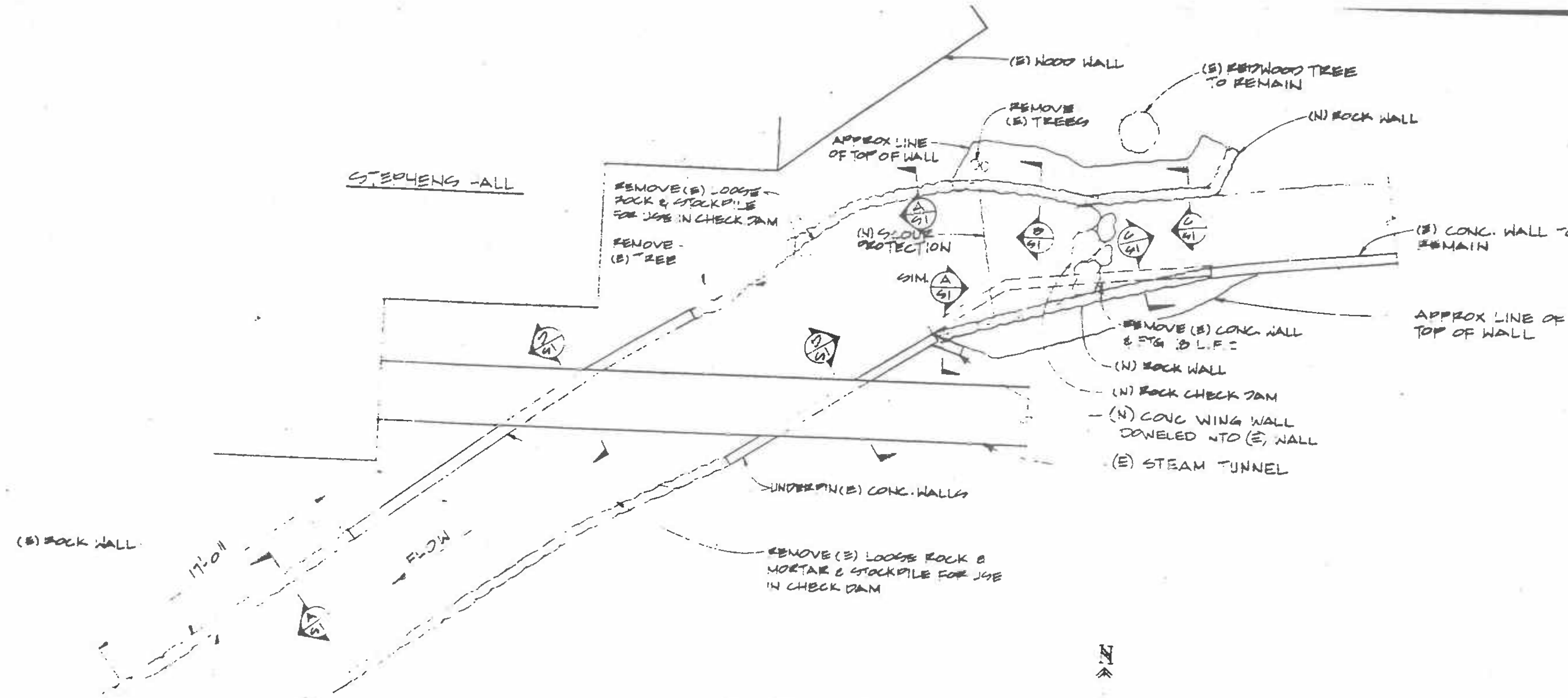
E. Final Cleanup —
Contractor shall remove all spoil, construction debris, and [illegible] under stockpiles, and leave site neat after repairing any damage to roadways, plantings and turf.

STRAWBERRY CREEK RESTORATION
UNIVERSITY OF CALIFORNIA – BERKELEY
FACILITIES MANAGEMENT DEPARTMENT

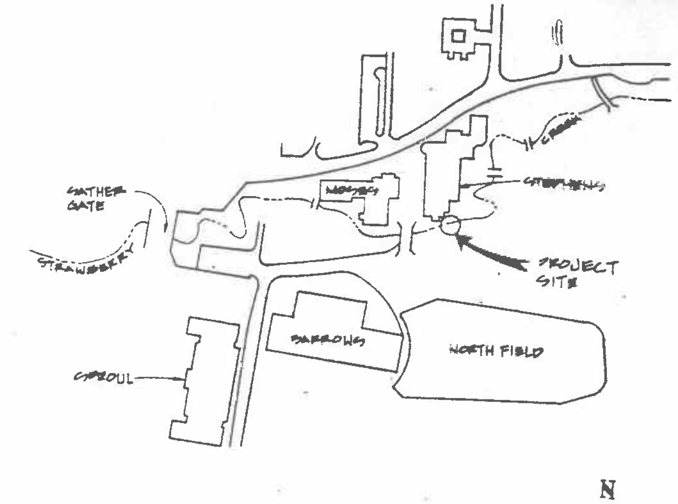
SCALE: 1/4" = 1'	APPROVED BY:	DRAWN BY
DATE: 5/10/88		REVISED

REDWOOD LOG STREAMBANK PROTECTION
STEPHEN/MOSES BRIDGE SITE

CONSULTING: PHILIP WILLIAMS & ASSOC. — DESIGN: [illegible] MECHANICAL — DRAWING NO. 1 OF [illegible]



PARTIAL SITE PLAN
1" = 5'



VICINITY MAP
1" = 200'

GENERAL NOTES

ALL WORK SHALL CONFORM TO ALL LOCAL BUILDING CODES AND ORDINANCES.

FOOTINGS SHALL BEAR ON FIRM, UNDISTURBED SOIL, WEATHERED ROCK OR ROCK. EXCAVATION SHALL BE FREE OF WATER AND LOOSE ROCK.

CONCRETE PLACEMENT SHALL CONFORM TO ACI 301-72 CHAPTER 8 (REVISED 1981).

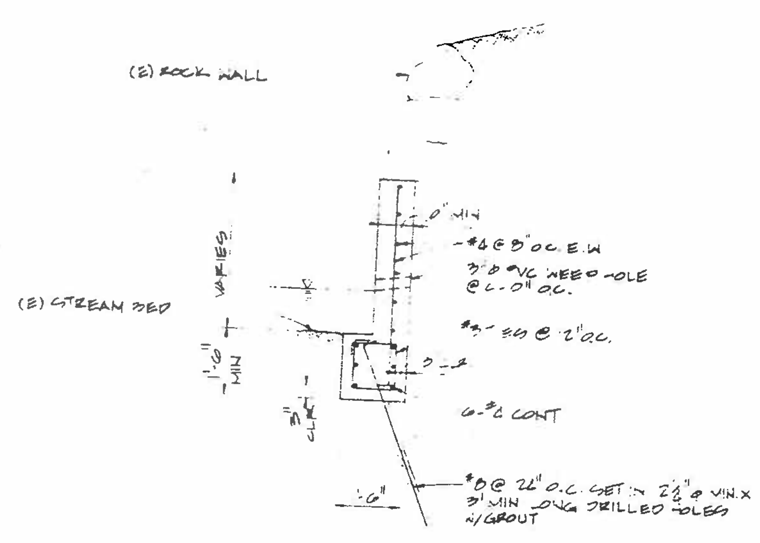
CONCRETE FOR FOUNDATIONS SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 3500 PSI IN 28 DAYS.

REINFORCING STEEL SHALL BE DEFORMED BILLET STEEL BARS CONFORMING TO ASTM A615-85, GRADE 60. BARS SHALL BE CONTINUOUS AROUND CORNERS AND LAPPED 40 DIAMETERS FOR GRADE 60 BARS UNLESS OTHERWISE SHOWN.

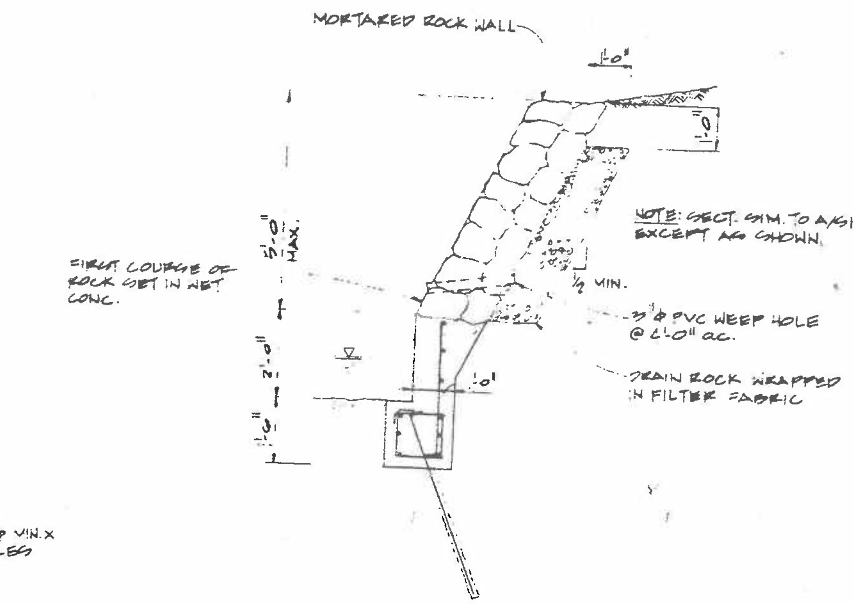
JOB SITE REVIEW: THE CONTRACTOR SHALL NOTIFY THE ENGINEER AT LEAST TWO DAYS PRIOR TO POURING ANY CONCRETE SO THAT THE DESIGNED REINFORCING STEEL REVIEW CAN BE MADE.

SAFETY MEASURES: AT ALL TIMES THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF PERSONS AND PROPERTY, AND FOR ALL NECESSARY INDEPENDENT ENGINEERING REVIEWS OF THESE CONDITIONS. THE ENGINEER'S JOB SITE REVIEW IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES.

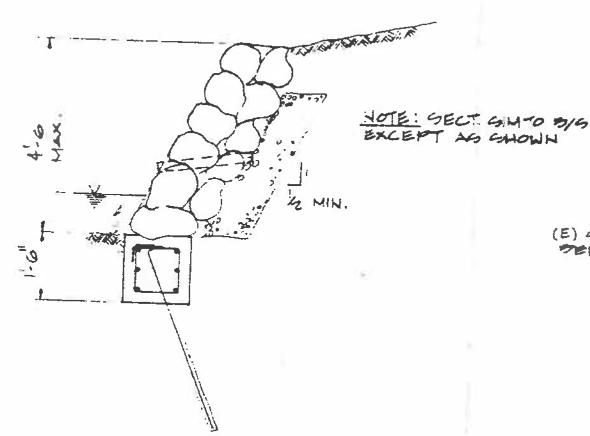
ROCK WALLS SHALL MATCH EXISTING ROCK WALLS ON STRAWBERRY CREEK ACROSS FROM DWINELLE ANNEX. SUBMIT ROCK SAMPLES TO ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION. ROCK SHALL BE LAID IN MORTARED BED JOINTS AND ALL VOIDS SHALL BE MORTARED SOLID.



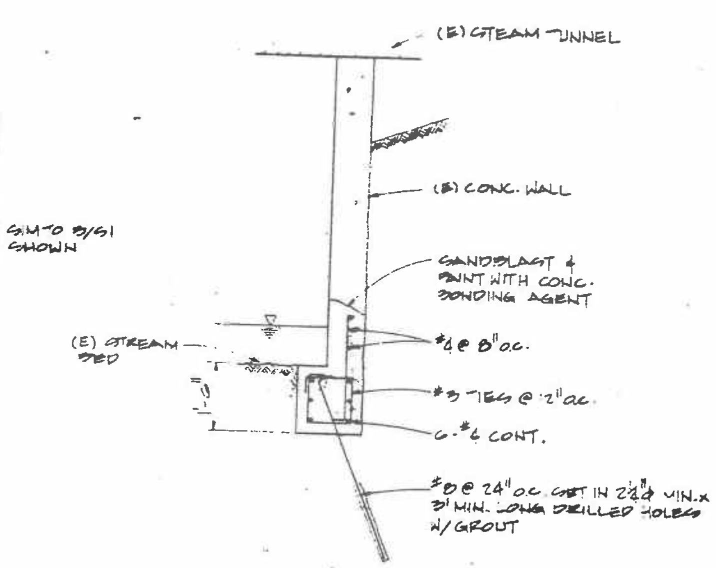
SECTION A/S1
½" = 1'-0"



SECTION B/S1
½" = 1'-0"



SECTION C/S1
½" = 1'-0"



SECTION D/1
½" = 1'-0"

No.	Revision	Date	By	App'd
△				
△				
△				

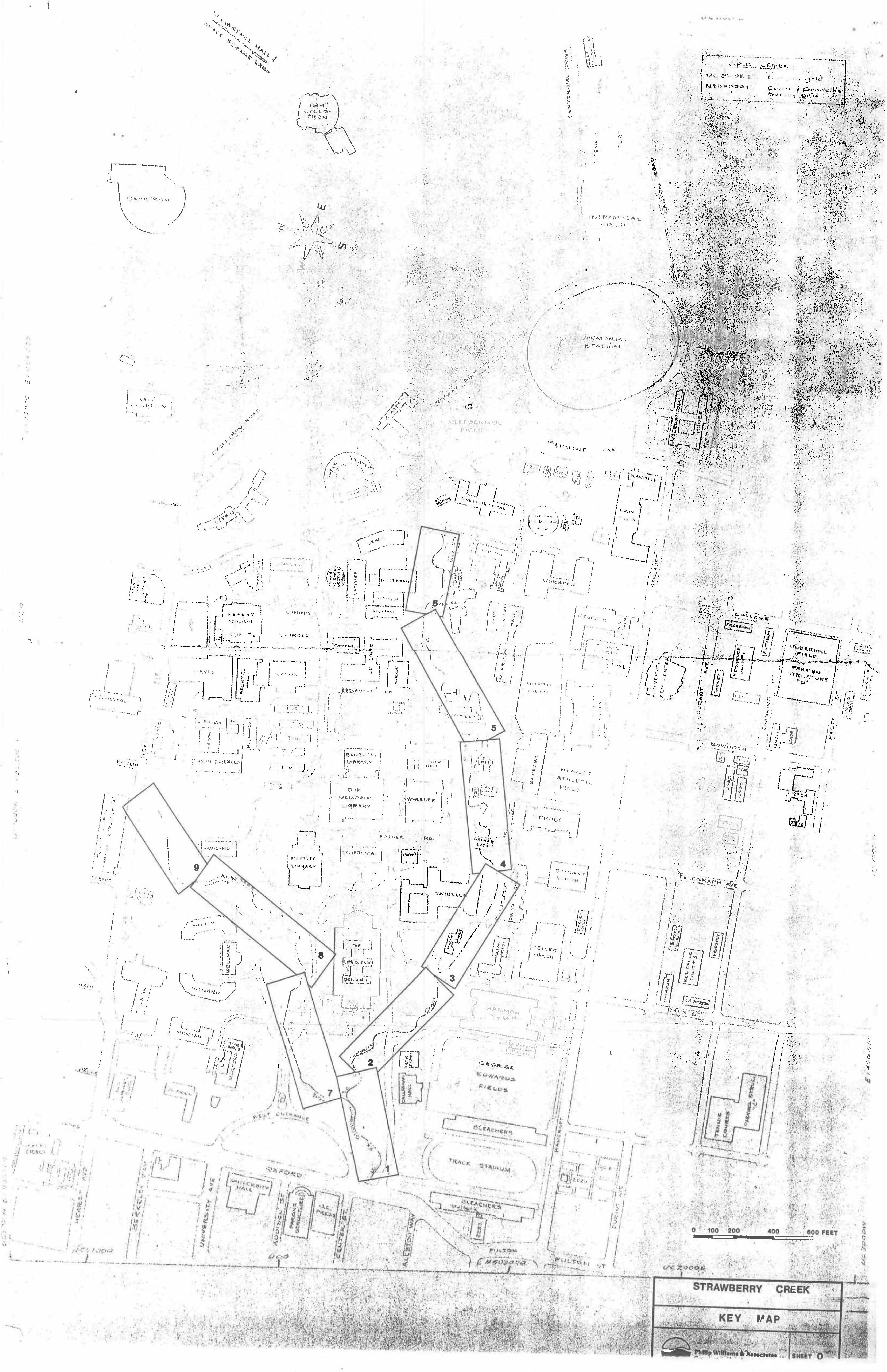
THOMAS P. CHRISTIAN Structural Engineer
267 Fourth Street / Oakland, California 94607 / 415-452-2488

STRAWBERRY CREEK EROSION CONTROL
UNIVERSITY OF CALIFORNIA, BERKELEY
PHILIP WILLIAMS & ASSOCIATES
SAN FRANCISCO, CA.

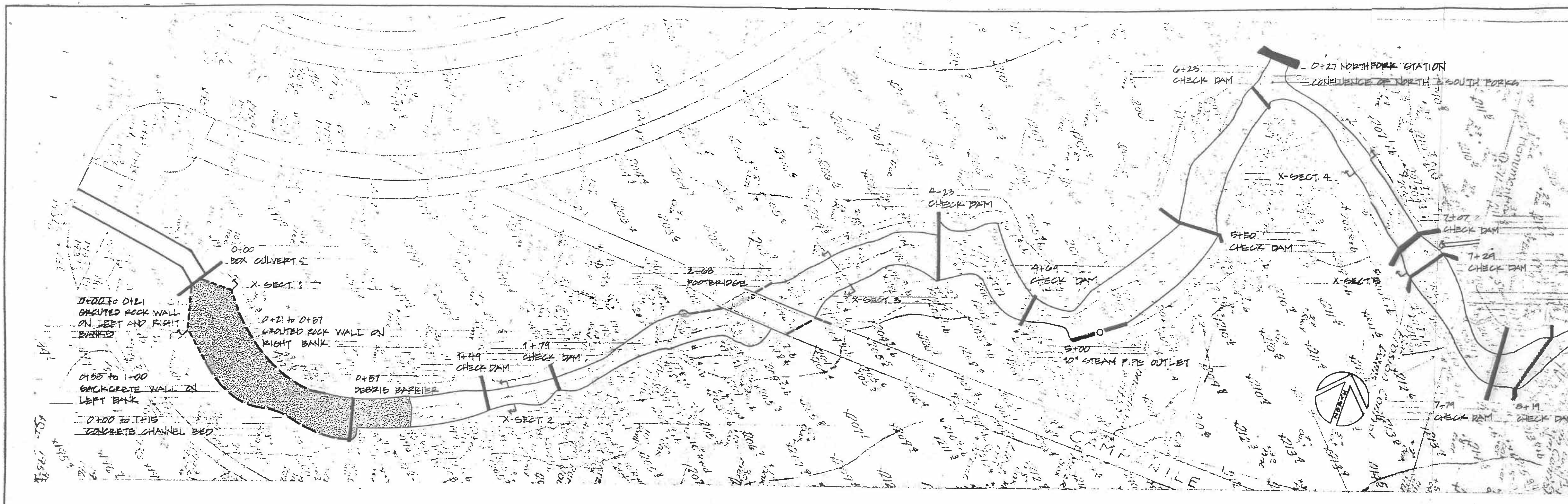
PARTIAL SITE PLAN, SECTIONS AND GENERAL NOTES

Drawn By Z.C.
Date 5-13-88
App'd By TC
Project No. 88021

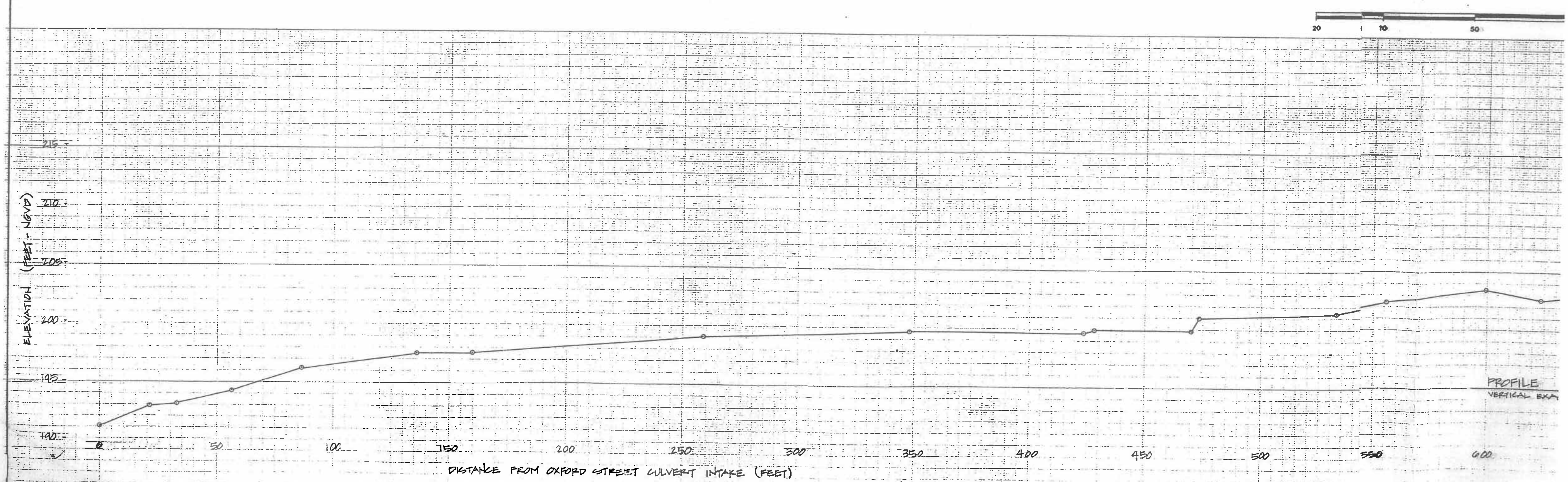
Revision △
Sheet No.
S1 of 1



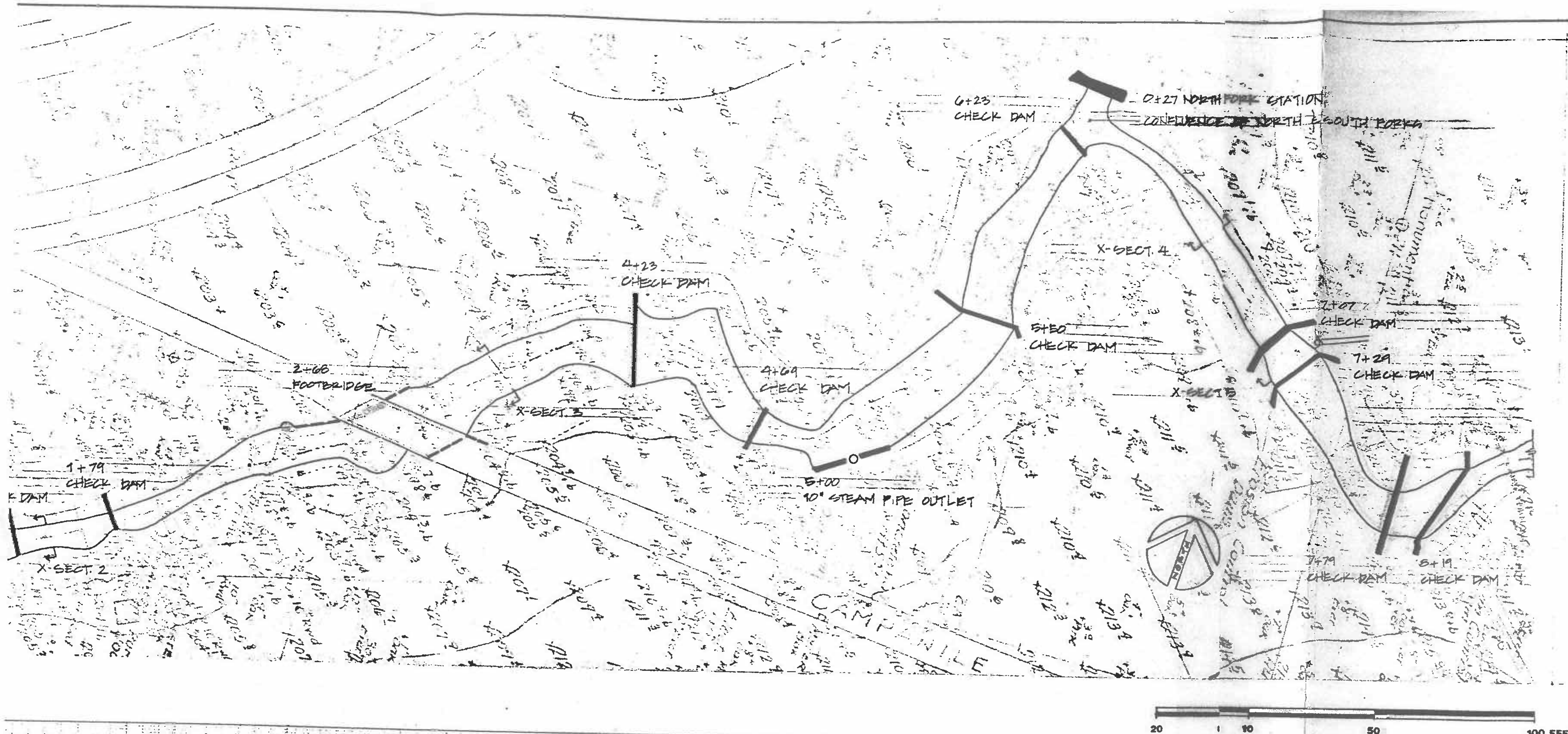
STRAWBERRY CREEK
KEY MAP
Philip Williams & Associates
SHEET 0
GRID LEGEND
MEMORIAL STADIUM
INTRAMURAL FIELD
INTERNATIONAL HOUSE
PIEDMONT AVE
UNDERHILL FIELD
PARKING STRUCTURE "D"
COLLEGE
BOWDITCH
TELEGRAPH AVE
DANA ST
DURANT AVE
WEBSTER
NORTH FIELD
HEARST ATHLETIC FIELD
SATHER GATE
SATHER RD.
WHEELER
DOE MEMORIAL LIBRARY
BANCROFT LIBRARY
MOFFITT LIBRARY
CALIFORNIA
DWINELLE
LIFE SCIENCES BUILDING
HARMON GYM
GEORGE EDWARDS FIELDS
BLEACHERS
TRACK STADIUM
STUDENT UNION
ZELLERBACH
WELLMAN
HILGARD
MORGAN
GIANNINI
HAVILAND
DAVIS
EARTH SCIENCES
WEST ENTRANCE
OXFORD
UNIVERSITY HALL
BERKELEY WAY
UNIVERSITY AVE
ADDISON ST
CENTER ST
ALLSTON WAY
FULTON
BANCROFT
HEARST AVE
KLEEBERGER FIELD
GREEK THEATER
CENTENNIAL DRIVE
CANYON ROAD
TENNIS COURTS
PARKING STRUC.
TO LAWRENCE HALL & SPACE SCIENCE LABS
184" CYCLOTRON
BEVATRON
N
E
S
W
1
2
3
4
5
6
7
8
9
0 100 200 400 800 FEET

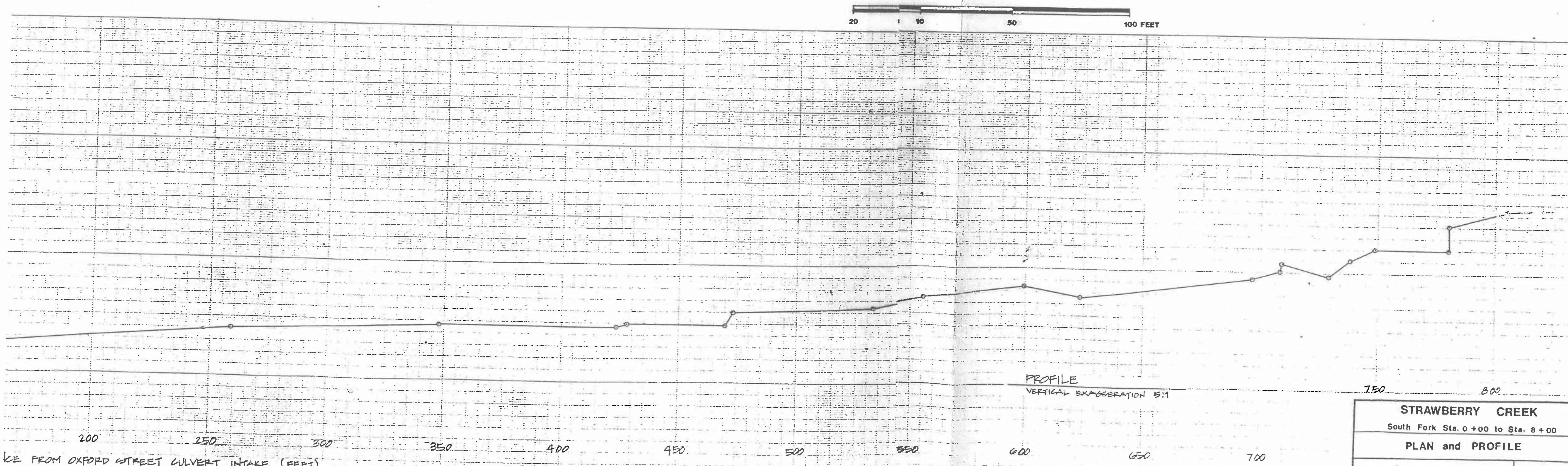


0+00
BOX CULVERT
X-SECT. 1
0+00 to 0+21
GROUTED ROCK WALL ON LEFT AND RIGHT BANKS
0+21 to 0+87
GROUTED ROCK WALL ON RIGHT BANK
0+55 to 1+00
SACKCRETE WALL ON LEFT BANK
0+00 to 1+15
CONCRETE CHANNEL BED
0+87
DEBRIS BARRIER
1+49
CHECK DAM
1+79
CHECK DAM
X-SECT. 2
2+68
FOOTBRIDGE
X-SECT. 3
4+23
CHECK DAM
4+69
CHECK DAM
5+00
10" STEAM PIPE OUTLET
5+80
CHECK DAM
6+23
CHECK DAM
0+27 NORTH FORK STATION
CONFLUENCE OF NORTH & SOUTH FORKS
X-SECT. 4
X-SECT. 5
7+07
CHECK DAM
7+29
CHECK DAM
7+79
CHECK DAM
8+19
CHECK DAM
NORTH
20
10
50



ELEVATION (FEET - NGVD)
190
195
200
205
210
215
0
50
100
150
200
250
300
350
400
450
500
550
600
DISTANCE FROM OXFORD STREET CULVERT INTAKE (FEET)
PROFILE
VERTICAL EXA





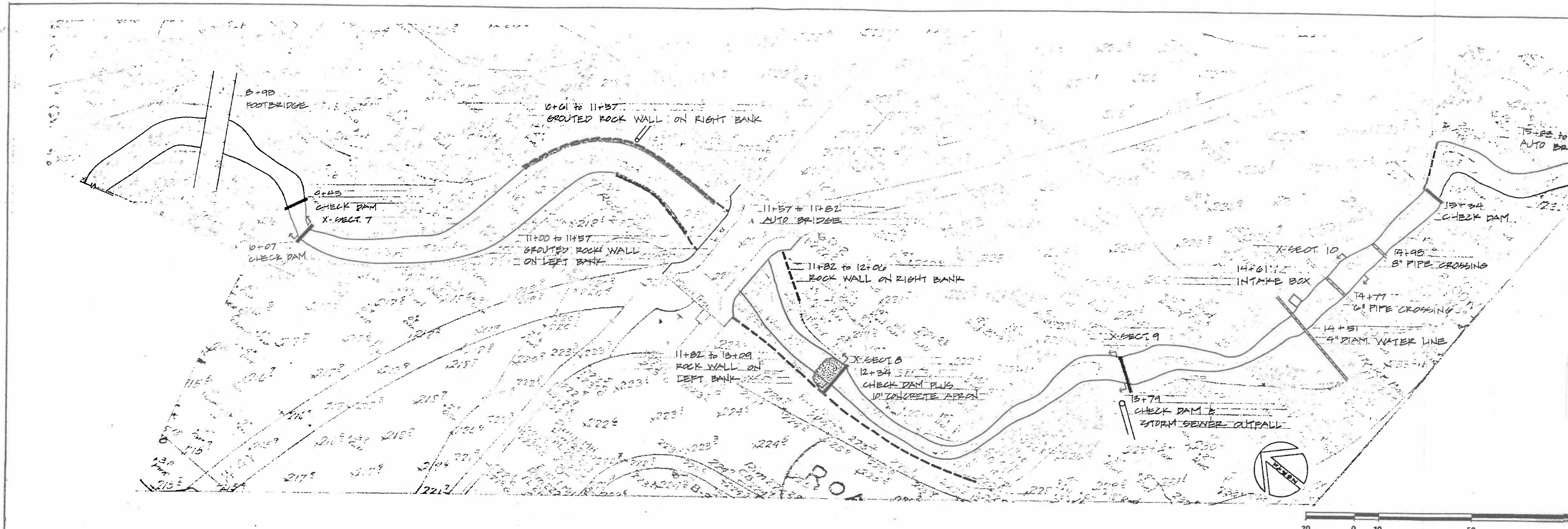
STRAWBERRY CREEK

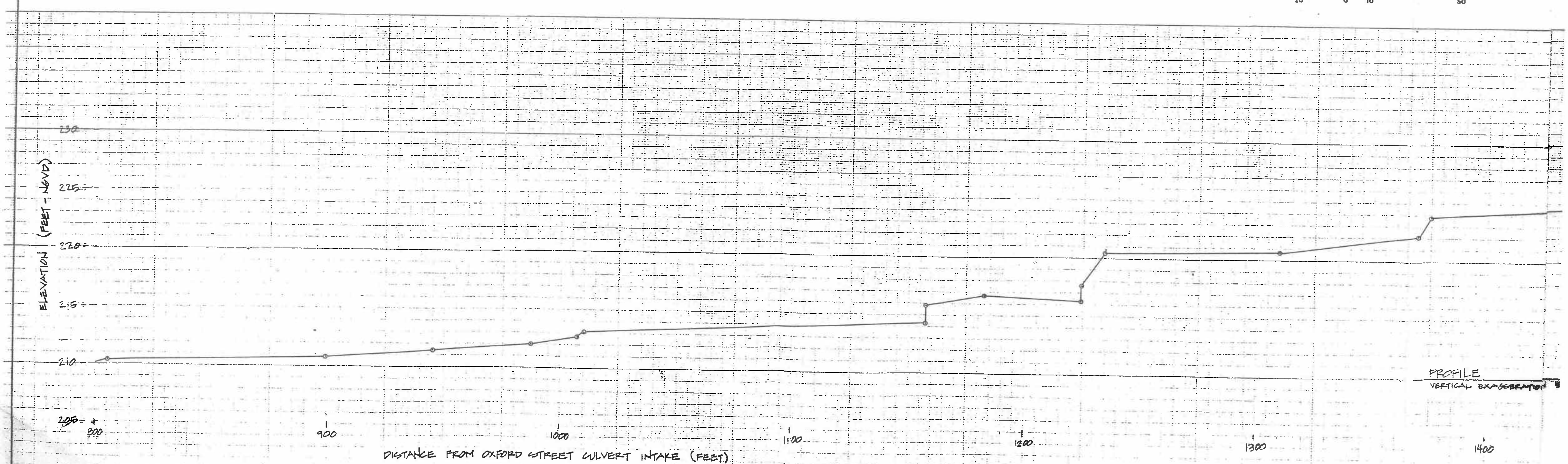
South Fork Sta. 0 +00 to Sta. 8 + 00

PLAN and PROFILE

Philip Williams & Associates
Consultants in Hydrology

SHEET 1 of 9


8+98
FOOTBRIDGE
10+61 to 11+57
GROUTED ROCK WALL ON RIGHT BANK
9+45
CHECK DAM
X-SECT. 7
10+07
CHECK DAM
11+00 to 11+57
GROUTED ROCK WALL
ON LEFT BANK
11+57 to 11+82
AUTO BRIDGE
11+82 to 12+06
ROCK WALL ON RIGHT BANK
11+82 to 13+09
ROCK WALL ON
LEFT BANK
X-SECT. 8
12+34
CHECK DAM PLUS
10' CONCRETE APRON
X-SECT. 9
13+79
CHECK DAM &
STORM SEWER OUTFALL
X-SECT. 10
14+61
INTAKE BOX
14+98
8" PIPE CROSSING
14+77
6" PIPE CROSSING
14+51
4" DIAM. WATER LINE
15+34
CHECK DAM
15+88 to
AUTO BRIDGE
20
0
10
50


230
225
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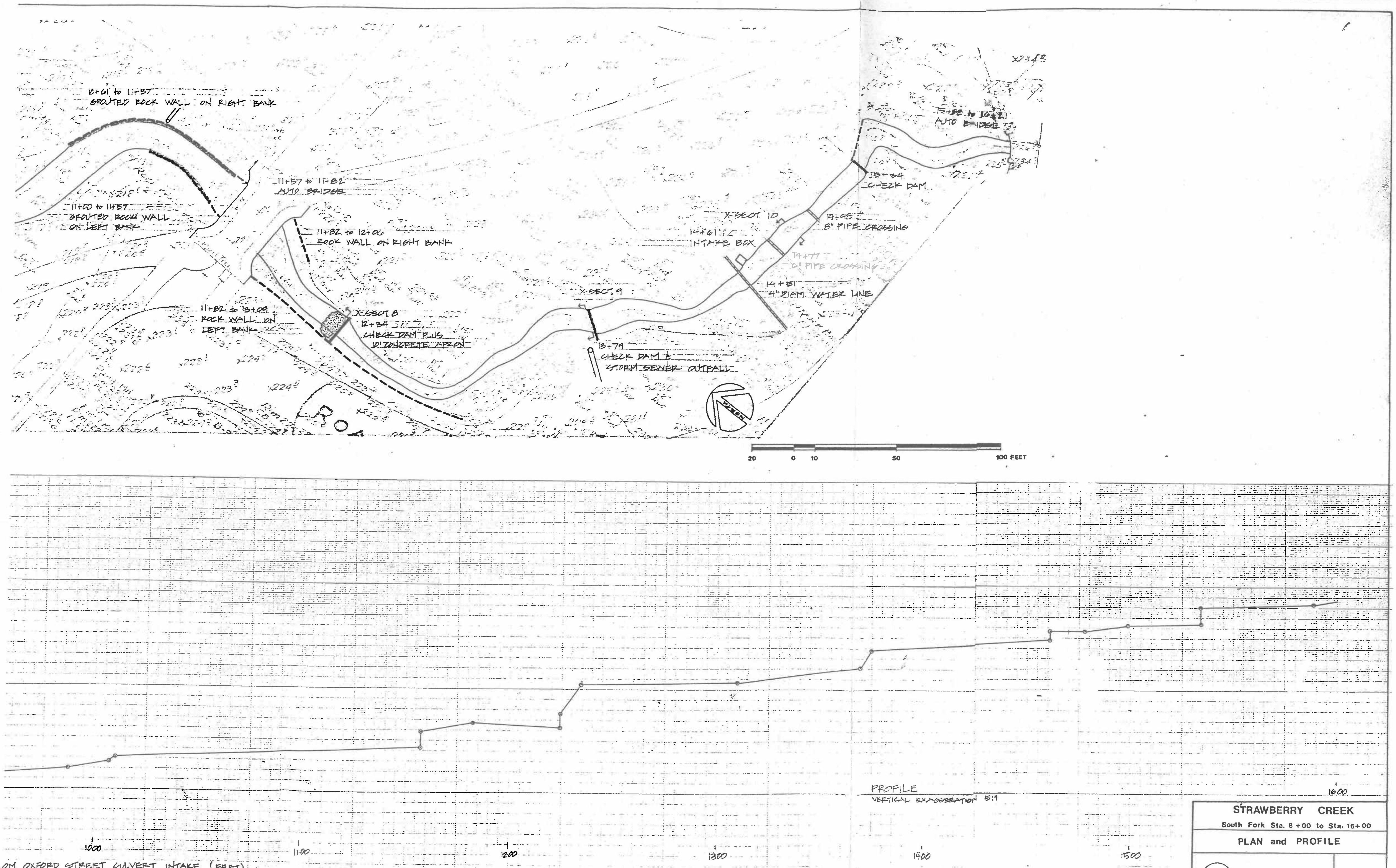
210
205
ELEVATION (FEET - NGVD)
800
900
1000
1100
1200
1300
1400
DISTANCE FROM OXFORD STREET CULVERT INTAKE (FEET)
PROFILE
VERTICAL EXAGGERATION



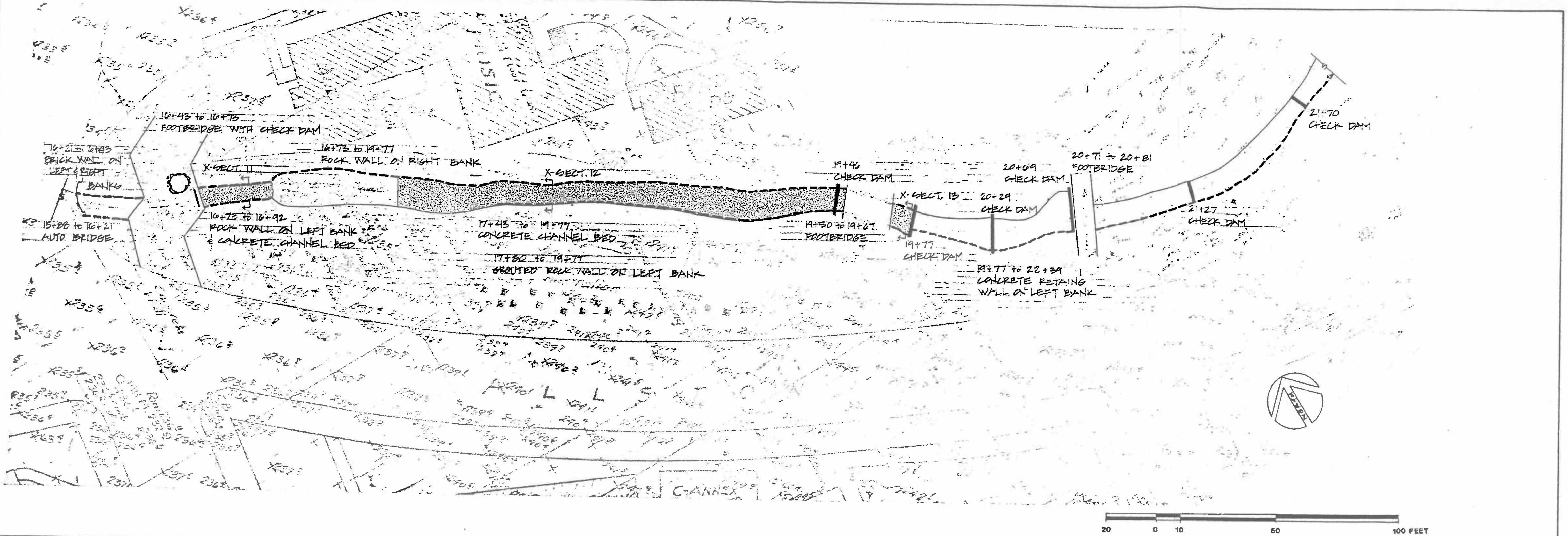
STRAWBERRY CREEK

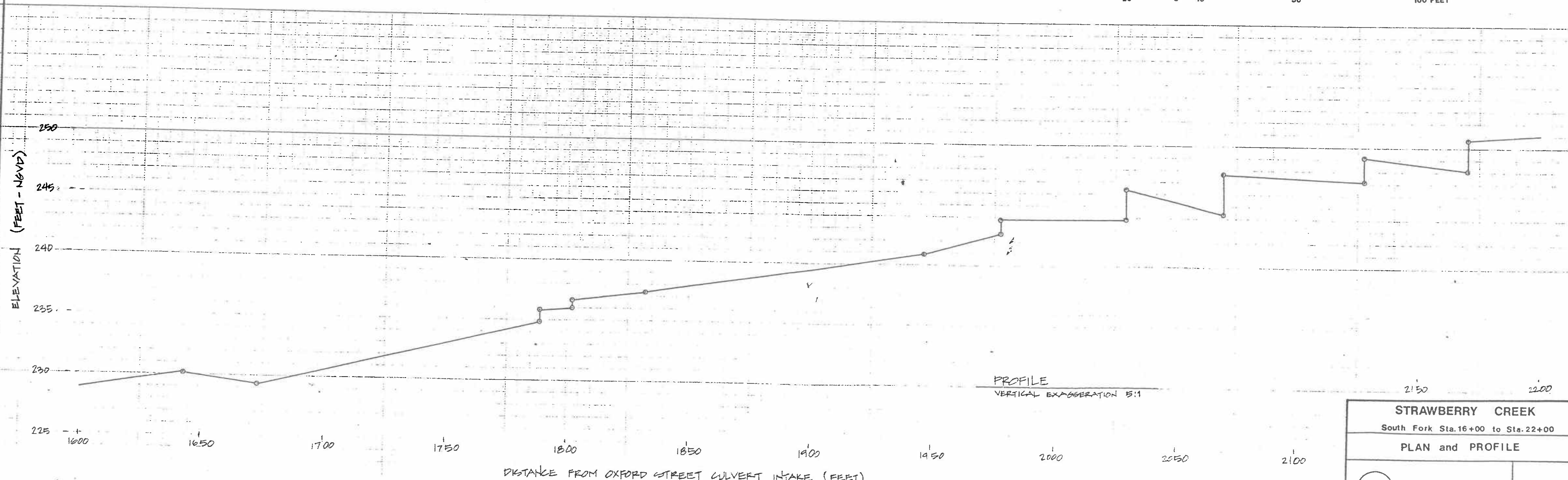
South Fork Sta. 8+00 to Sta. 16+00

PLAN and PROFILE

Philip Williams & Associates
Consultants in Hydrology

SHEET 2 of 9





STRAWBERRY CREEK

South Fork Sta. 16+00 to Sta. 22+00

PLAN and PROFILE

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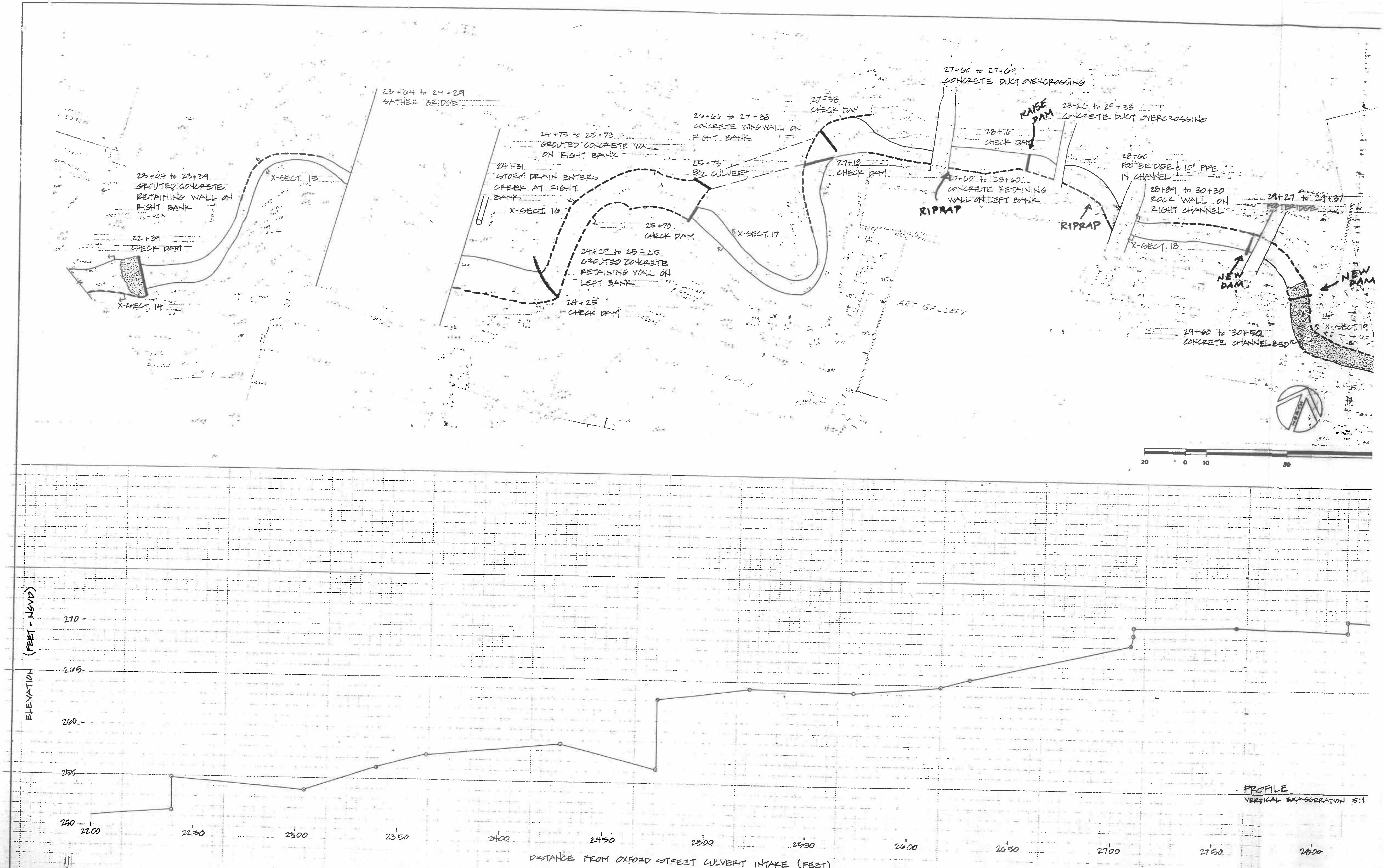
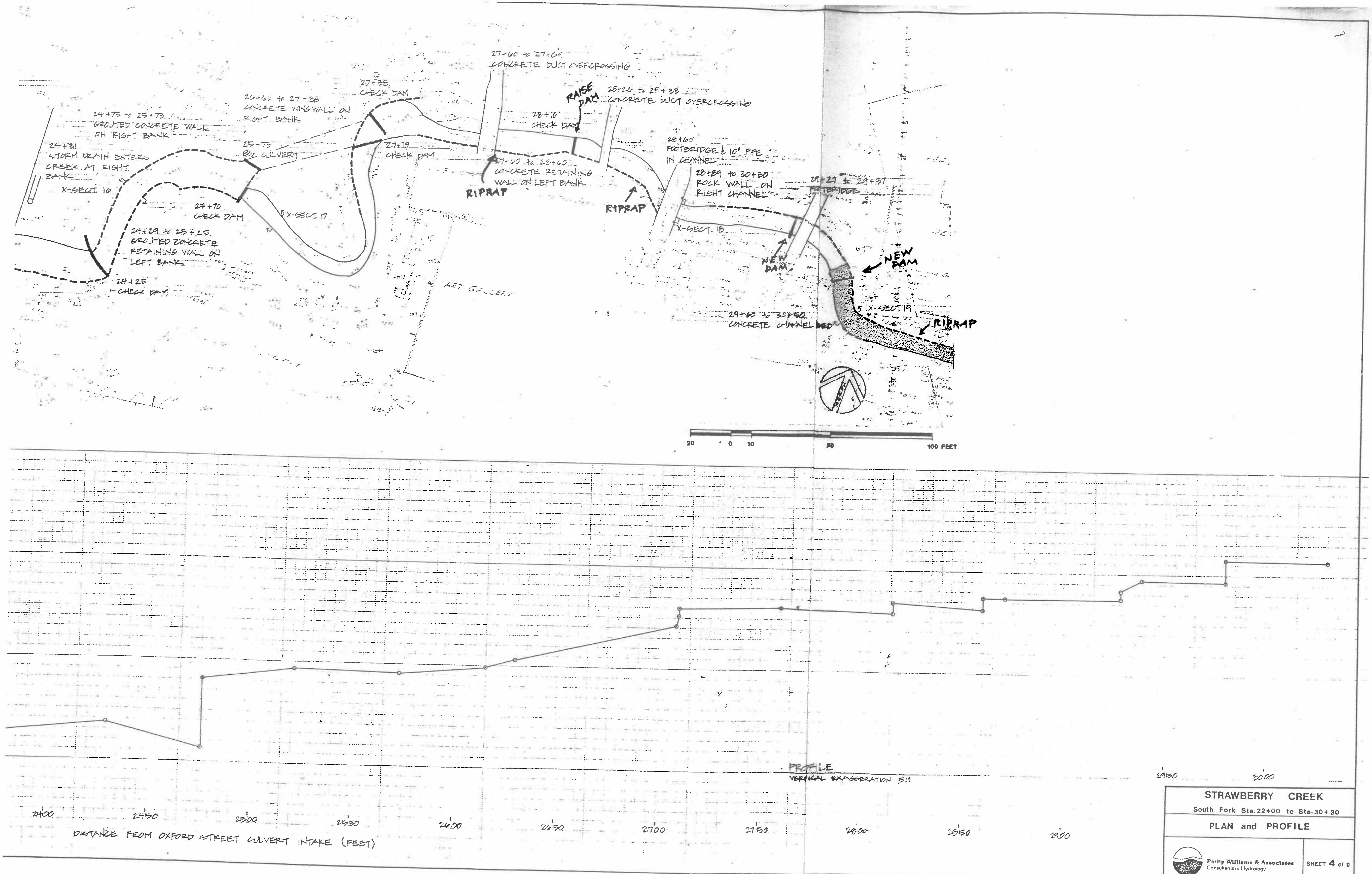
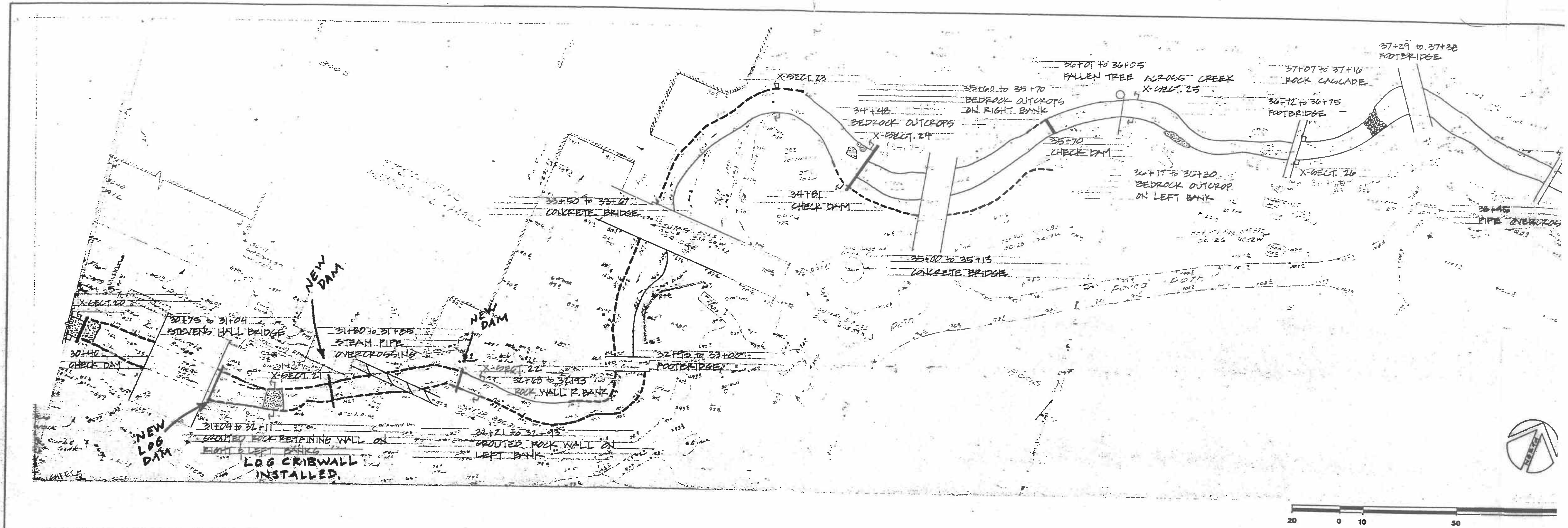
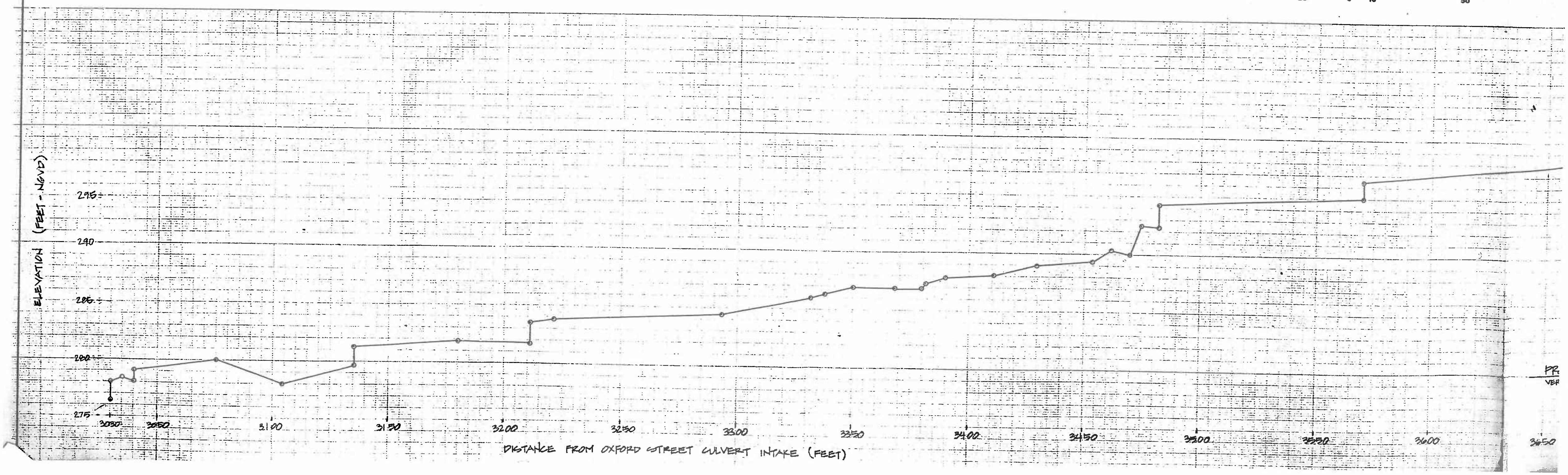
SHEET 3 of 9

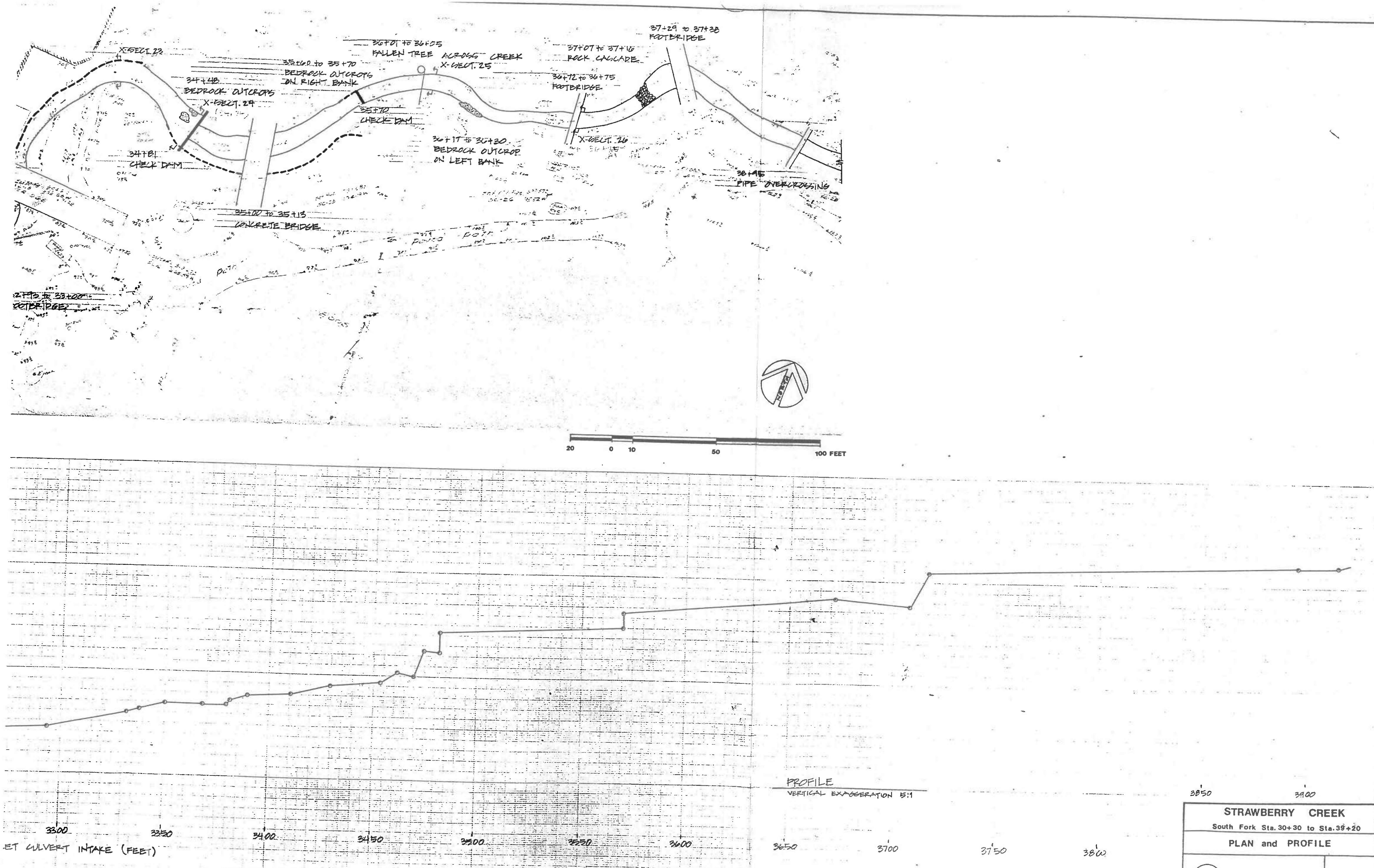


23+64 to 24+29 SATHER BRIDGE
27+60 to 27+69 CONCRETE DUCT OVERCROSSING
27+38 CHECK DAM
26+66 to 27+38 CONCRETE WINGWALL ON RIGHT BANK
24+73 to 25+73 GROUTED CONCRETE WALL ON RIGHT BANK
RAISE DAM
28+26 to 28+33 CONCRETE DUCT OVERCROSSING
28+16 CHECK DAM
25+73 BOX CULVERT
27+18 CHECK DAM
28+60 FOOTBRIDGE & 10" PIPE IN CHANNEL
23+04 to 23+39 GROUTED CONCRETE RETAINING WALL ON RIGHT BANK
X-SECT. 15
24+31 STORM DRAIN ENTERS CREEK AT RIGHT BANK
X-SECT. 16
27+60 to 28+60 CONCRETE RETAINING WALL ON LEFT BANK
RIPRAP
RIPRAP
28+89 to 30+30 ROCK WALL ON RIGHT CHANNEL
29+27 to 29+37 FOOTBRIDGE
22+39 CHECK DAM
25+70 CHECK DAM
X-SECT. 17
X-SECT. 18
24+29 to 25+25 GROUTED CONCRETE RETAINING WALL ON LEFT BANK
NEW DAM
NEW DAM
X-SECT. 14
24+25 CHECK DAM
ART GALLERY
29+60 to 30+50 CONCRETE CHANNEL BED
X-SECT. 19
20 0 10 50
ELEVATION (FEET - NGVD)
270
265
260
255
250
2200
2250
2300
2350
2400
2450
2500
2550
2600
2650
2700
2750
2800
PROFILE
VERTICAL EXAGGERATION 5:1
DISTANCE FROM OXFORD STREET CULVERT INTAKE (FEET)


27+60 to 27+69
CONCRETE DUCT OVERCROSSING
27+38
CHECK DAM
26+65 to 27-38
CONCRETE WINGWALL ON RIGHT BANK
24+73 to 25+73
GROUTED CONCRETE WALL ON RIGHT BANK
24+31
STORM DRAIN ENTERS CREEK AT RIGHT BANK
X-SECT. 16
25-73
BOX CULVERT
27+18
CHECK DAM
28+10
CHECK DAM
RAISE DAM
28+26 to 28+33
CONCRETE DUCT OVERCROSSING
27+60 to 28+60
CONCRETE RETAINING WALL ON LEFT BANK
RIPRAP
RIPRAP
28+60
FOOTBRIDGE & 10" PIPE IN CHANNEL
28+89 to 30+30
ROCK WALL ON RIGHT CHANNEL
29+27 to 29+37
FOOTBRIDGE
X-SECT. 18
NEW DAM
NEW DAM
X-SECT. 19
RIPRAP
29+60 to 30+50
CONCRETE CHANNEL BED
25+70
CHECK DAM
X-SECT. 17
24+29 to 25+25
GROUTED CONCRETE RETAINING WALL ON LEFT BANK
24+25
CHECK DAM
ART GALLERY
20
0
10
50
100 FEET
PROFILE
VERTICAL EXAGGERATION 5:1
2400
2450
2500
2550
2600
2650
2700
2750
2800
2850
2900
2950
3000
DISTANCE FROM OXFORD STREET CULVERT INTAKE (FEET)
STRAWBERRY CREEK
South Fork Sta. 22+00 to Sta. 30+30
PLAN and PROFILE
Philip Williams & Associates
Consultants in Hydrology
SHEET 4 of 9


37+29 to 37+38 FOOTBRIDGE
36+01 to 36+05 FALLEN TREE ACROSS CREEK
X-SECT. 25
37+07 to 37+16 ROCK CASCADE
36+72 to 36+75 FOOTBRIDGE
X-SECT. 23
35+60 to 35+70 BEDROCK OUTCROPS ON RIGHT BANK
34+48 BEDROCK OUTCROPS
X-SECT. 24
35+70 CHECK DAM
36+17 to 36+30 BEDROCK OUTCROP ON LEFT BANK
X-SECT. 26
34+81 CHECK DAM
33+50 to 33+67 CONCRETE BRIDGE
38+45 PIPE OVERCROS
35+00 to 35+13 CONCRETE BRIDGE
NEW DAM
NEW DAM
X-SECT. 20
30+75 to 31+04 STEVENS HALL BRIDGE
30+40 CHECK DAM
31+80 to 31+85 STEAM PIPE OVERCROSSING
X-SECT. 21
X-SECT. 22
32+65 to 32+93 ROCK WALL R. BANK
32+93 to 33+00 FOOTBRIDGE
NEW LOG DAM
31+04 to 32+11 GROUTED ROCK RETAINING WALL ON RIGHT & LEFT BANKS
32+21 to 32+93 GROUTED ROCK WALL ON LEFT BANK
LOG CRIBWALL INSTALLED.
20 0 10 50


ELEVATION (FEET - NGVD)
295
290
285
280
275
3030
3050
3100
3150
3200
3250
3300
3350
3400
3450
3500
3550
3600
3650
DISTANCE FROM OXFORD STREET CULVERT INTAKE (FEET)



STRAWBERRY CREEK

South Fork Sta. 30+30 to Sta. 39+20

PLAN and PROFILE

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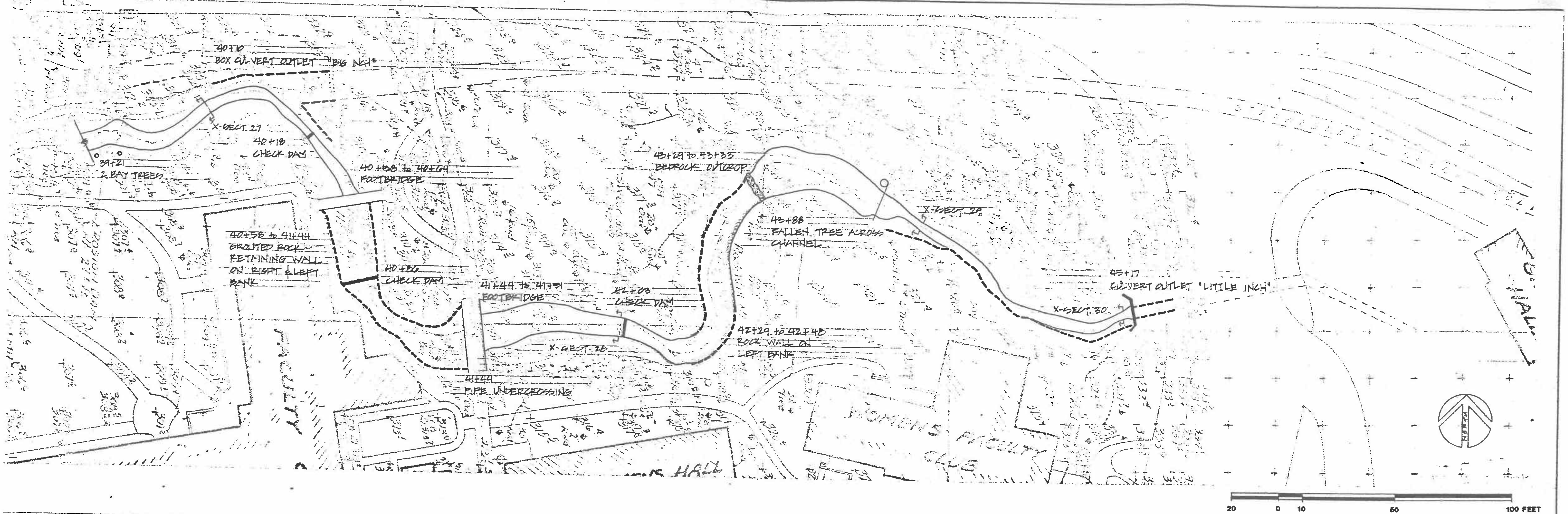
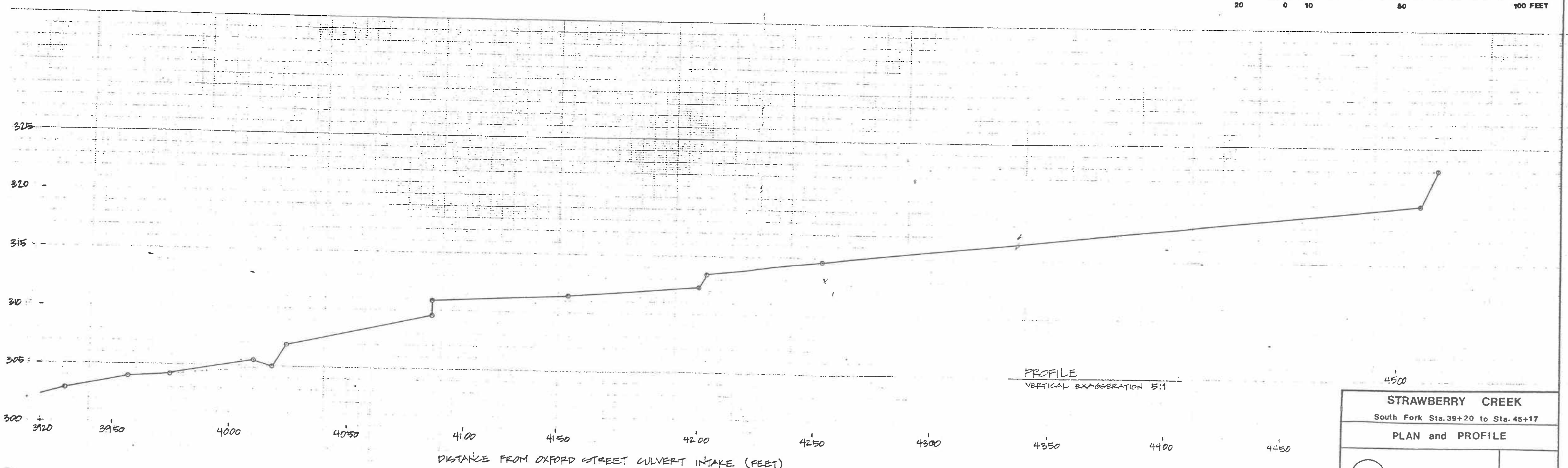
SHEET 5 of 9





STRAWBERRY CREEK

South Fork Sta. 39+20 to Sta. 45+17

PLAN and PROFILE

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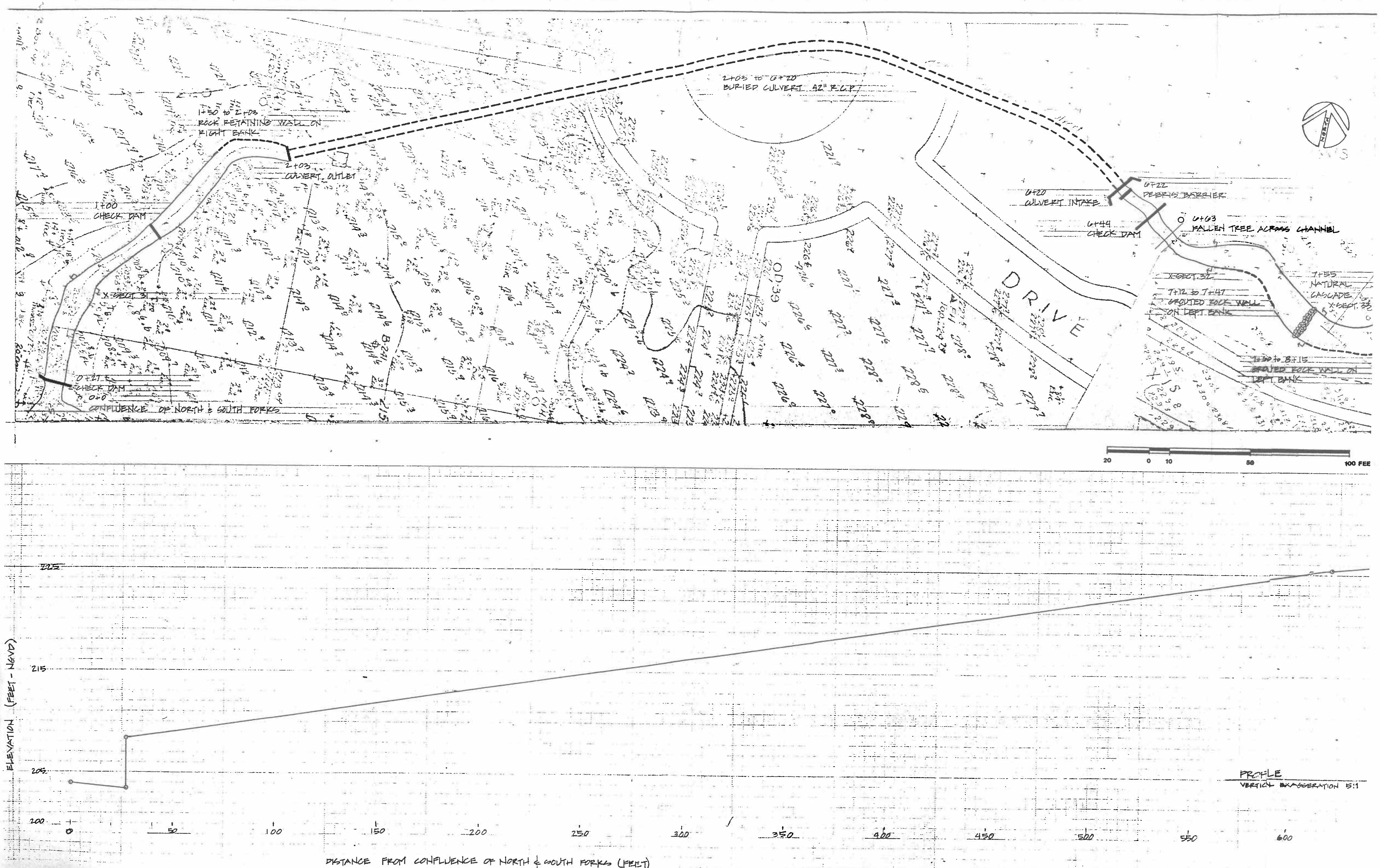
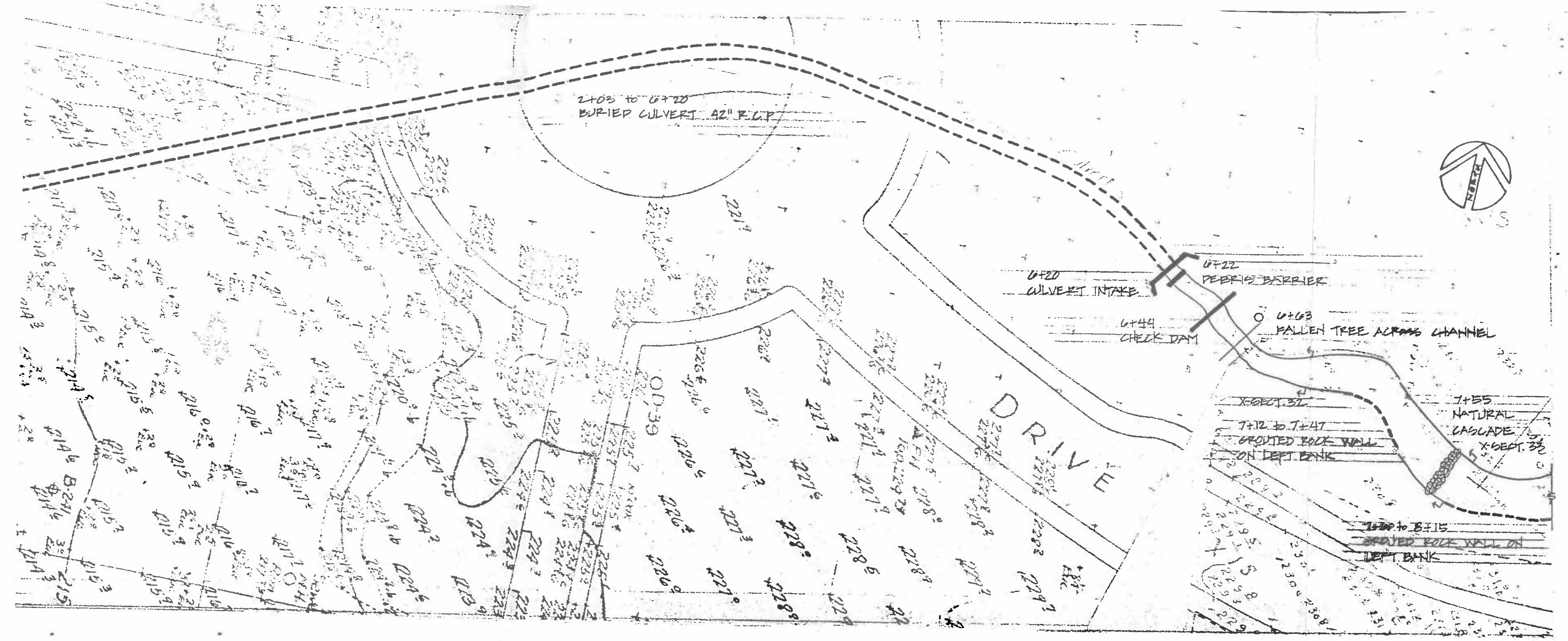
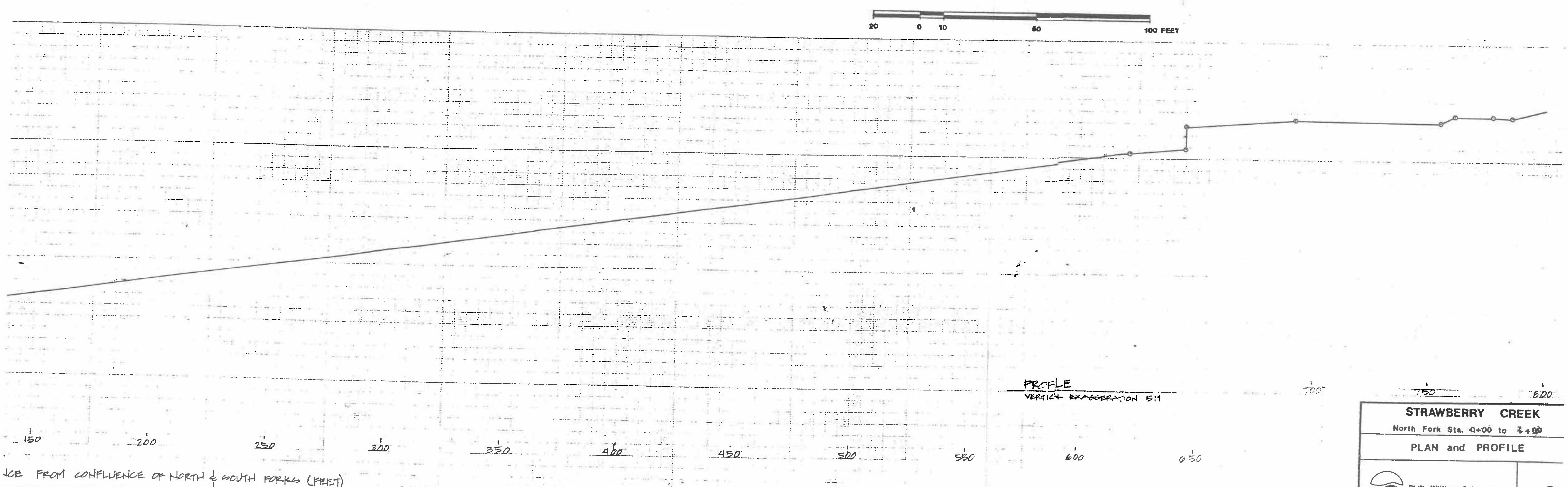
SHEET 6 of 9


2+03 to 6+20
BURIED CULVERT 42" R.C.P.
1+50 to 2+03
ROCK RETAINING WALL ON
RIGHT BANK
2+03
CULVERT OUTLET
1+00
CHECK DAM
X-SECT. 31
0+21.5
CHECK DAM
0+0
CONFLUENCE OF NORTH & SOUTH FORKS
OD-39
B-241
DRIVE
6+20
CULVERT INTAKE
6+22
DEBRIS BARRIER
6+49
CHECK DAM
6+63
FALLEN TREE ACROSS CHANNEL
X-SECT. 32
7+12 to 7+47
GROUTED ROCK WALL
ON LEFT BANK
7+55
NATURAL
CASCADE
X-SECT. 33
7+60 to 8+15
GROUTED ROCK WALL ON
LEFT BANK
NORTH
20
0
10
50
100 FEE
225
215
205
200
ELEVATION (FEET - NGVD)
0
50
100
150
200
250
300
350
400
450
500
550
600
DISTANCE FROM CONFLUENCE OF NORTH & SOUTH FORKS (FEET)
PROFILE
VERTICAL EXAGGERATION 5:1





STRAWBERRY CREEK

North Fork Sta. 0+00 to 8+00

PLAN and PROFILE

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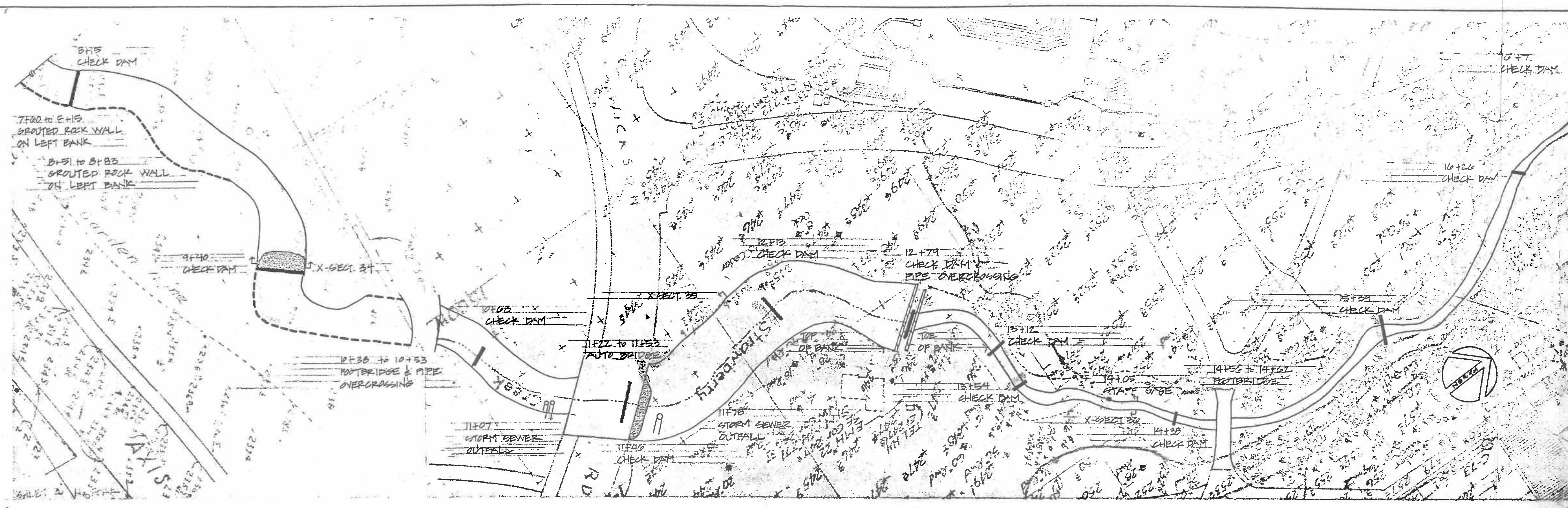
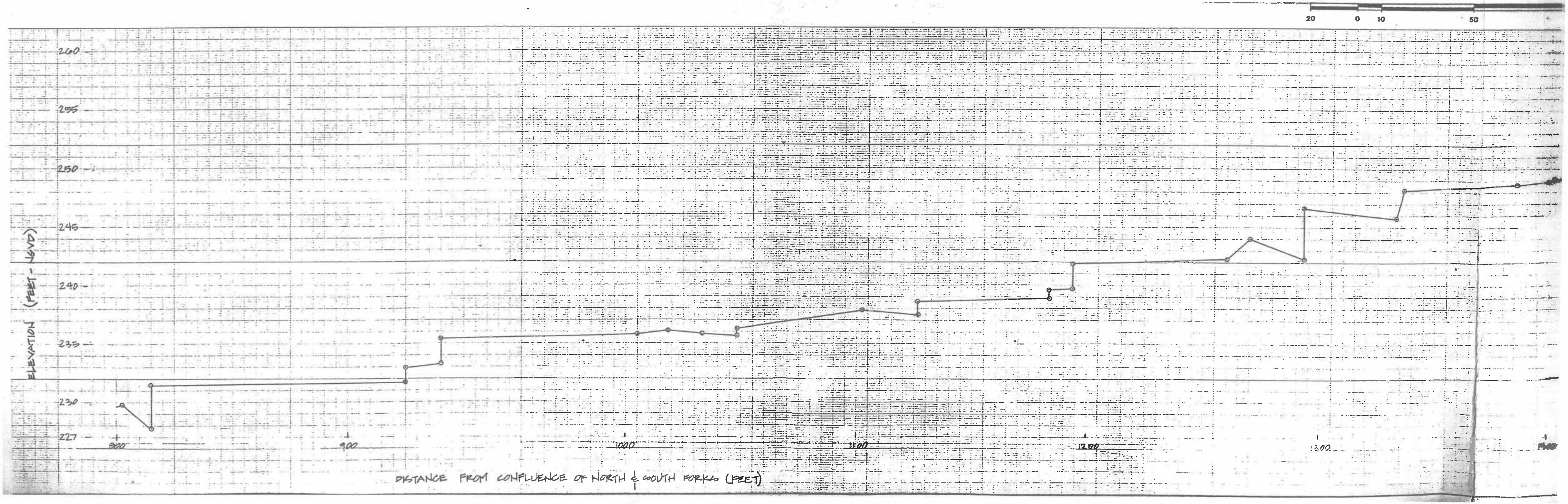
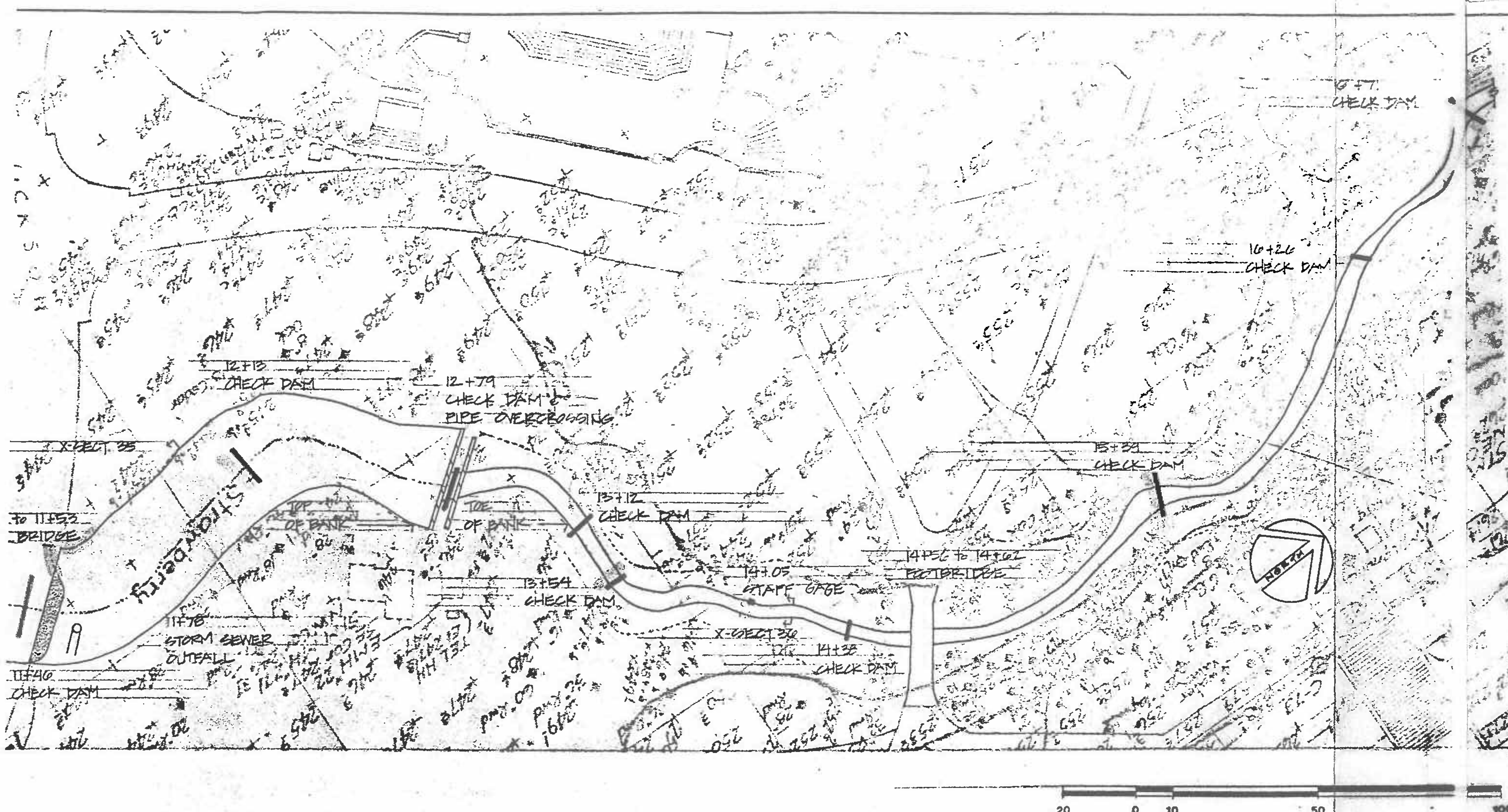
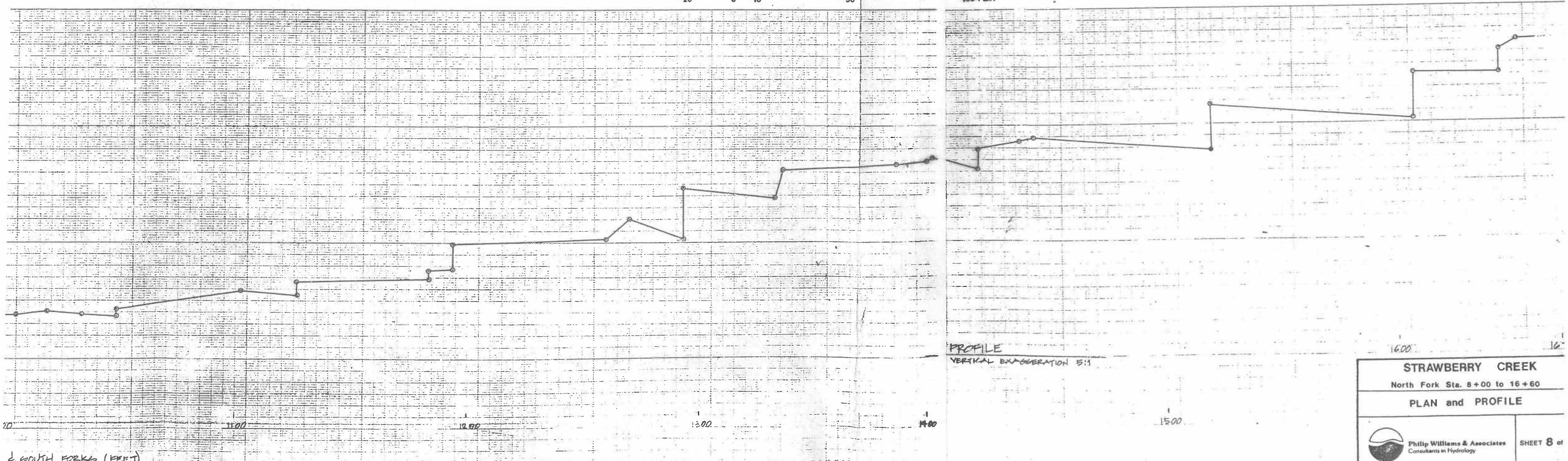
SHEET 7 of


8+15 CHECK DAM
7+00 to 8+15 GROUTED ROCK WALL ON LEFT BANK
8+51 to 8+83 GROUTED ROCK WALL ON LEFT BANK
9+40 CHECK DAM
X-SECT. 34
10+38 to 10+53 FOOTBRIDGE & PIPE OVERCROSSING
10+68 CHECK DAM
11+07 STORM SEWER OUTFALL
11+22 to 11+53 AUTO BRIDGE
11+46 CHECK DAM
X-SECT. 35
11+78 STORM SEWER OUTFALL
12+13 CHECK DAM
12+79 CHECK DAM & PIPE OVERCROSSING
TOE OF BANK
13+12 CHECK DAM
13+54 CHECK DAM
14+05 STAFF GAGE
X-SECT. 36
14+33 CHECK DAM
14+56 to 14+62 FOOTBRIDGE
15+51 CHECK DAM
16+26 CHECK DAM
16+71 CHECK DAM
Strawberry
WICKSON
RD
garden
NORTH
20 0 10 50


ELEVATION (FEET - NGVD)
260
255
250
245
240
235
230
227
800
900
1000
1100
1200
1300
DISTANCE FROM CONFLUENCE OF NORTH & SOUTH FORKS (FEET)





STRAWBERRY CREEK

North Fork Sta. 8+00 to 16+60

PLAN and PROFILE

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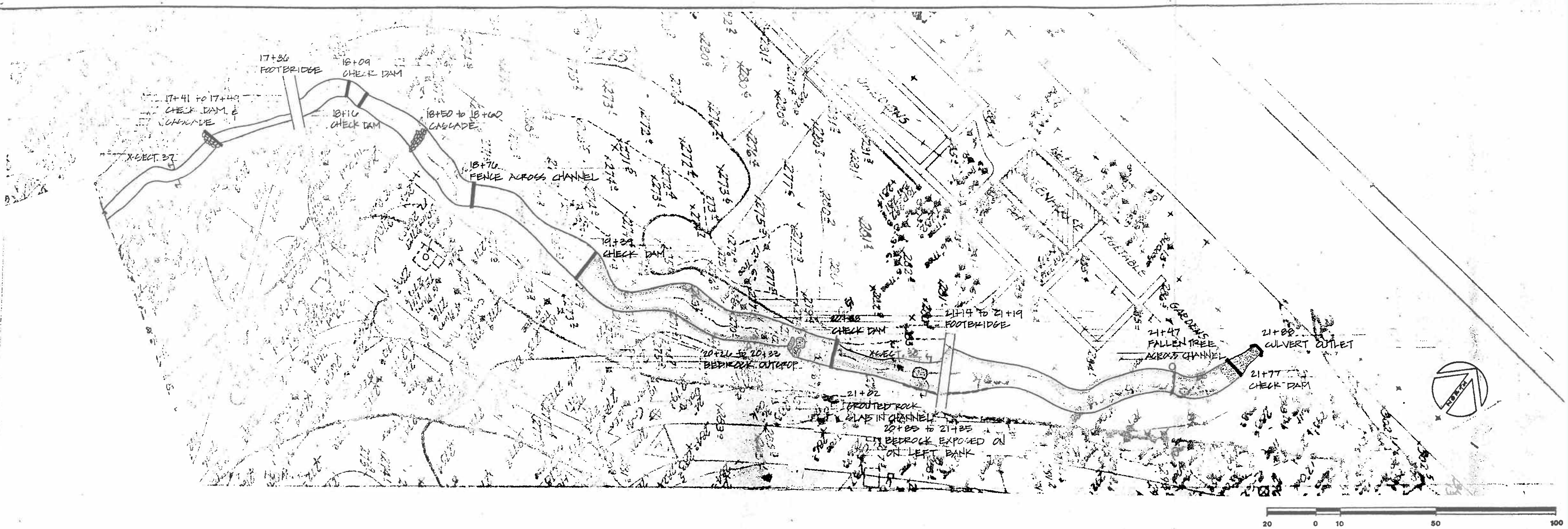
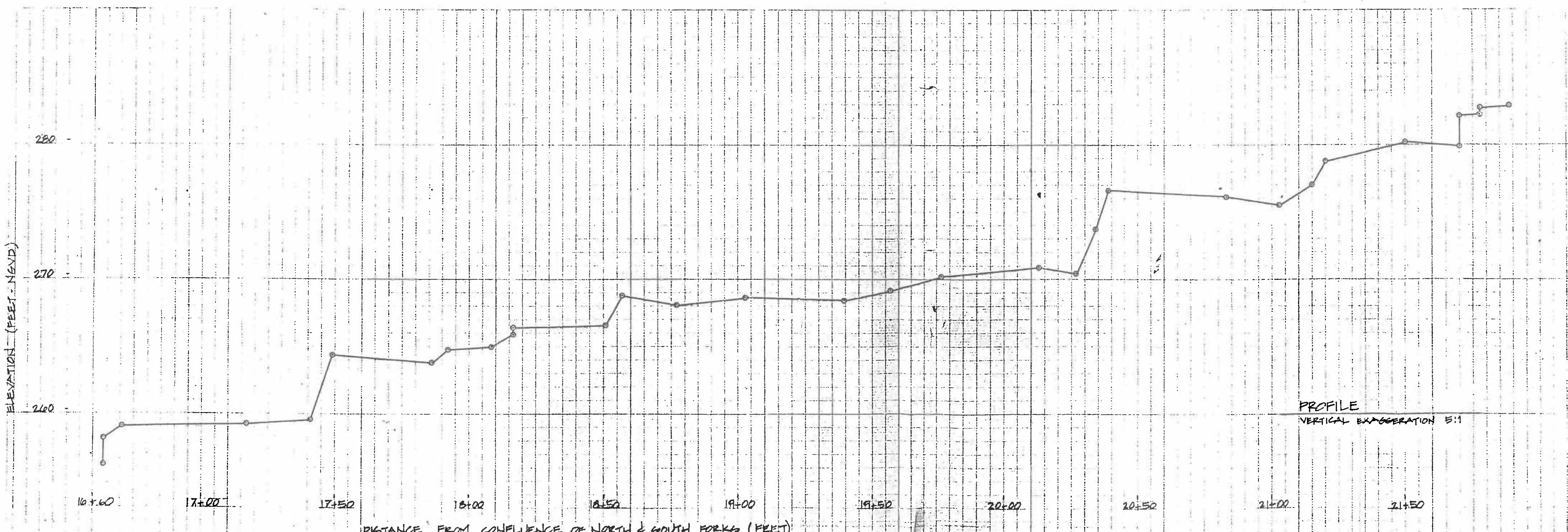
SHEET 8 of





STRAWBERRY CREEK

North Fork Sta. 16+60 to Sta. 21+

PLAN and PROFILE

Philip Williams & Associates
Consultants in Hydrology

SHEET