Report to the University of California and the People's Park Community Advisory Board on the Feasibility of Restoring Derby Creek at People's Park, Berkeley, California

Submitted by:
Wolfe Mason Associates, Inc.
in association with *Waterways Restoration Institute*

June 20,1998

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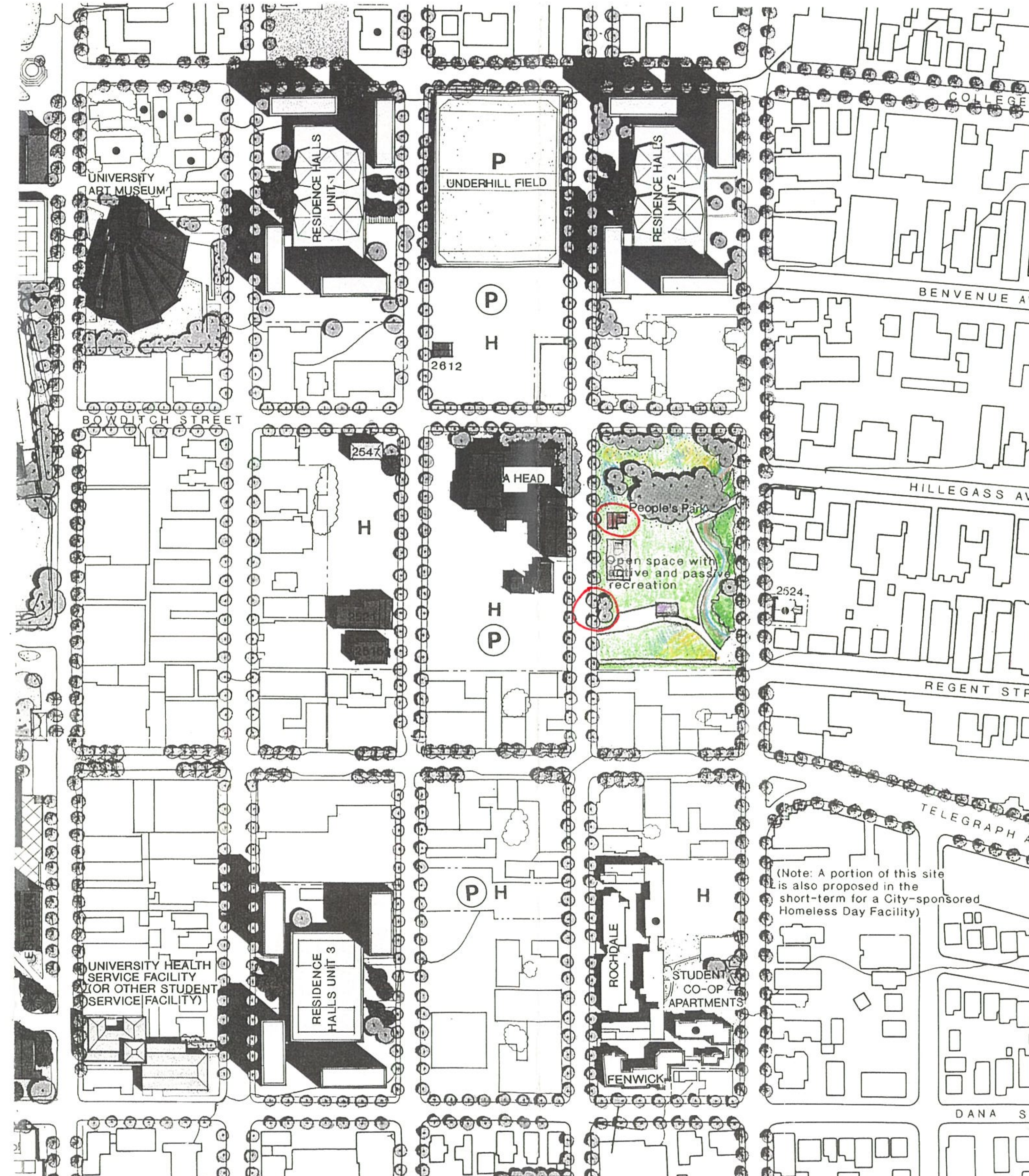

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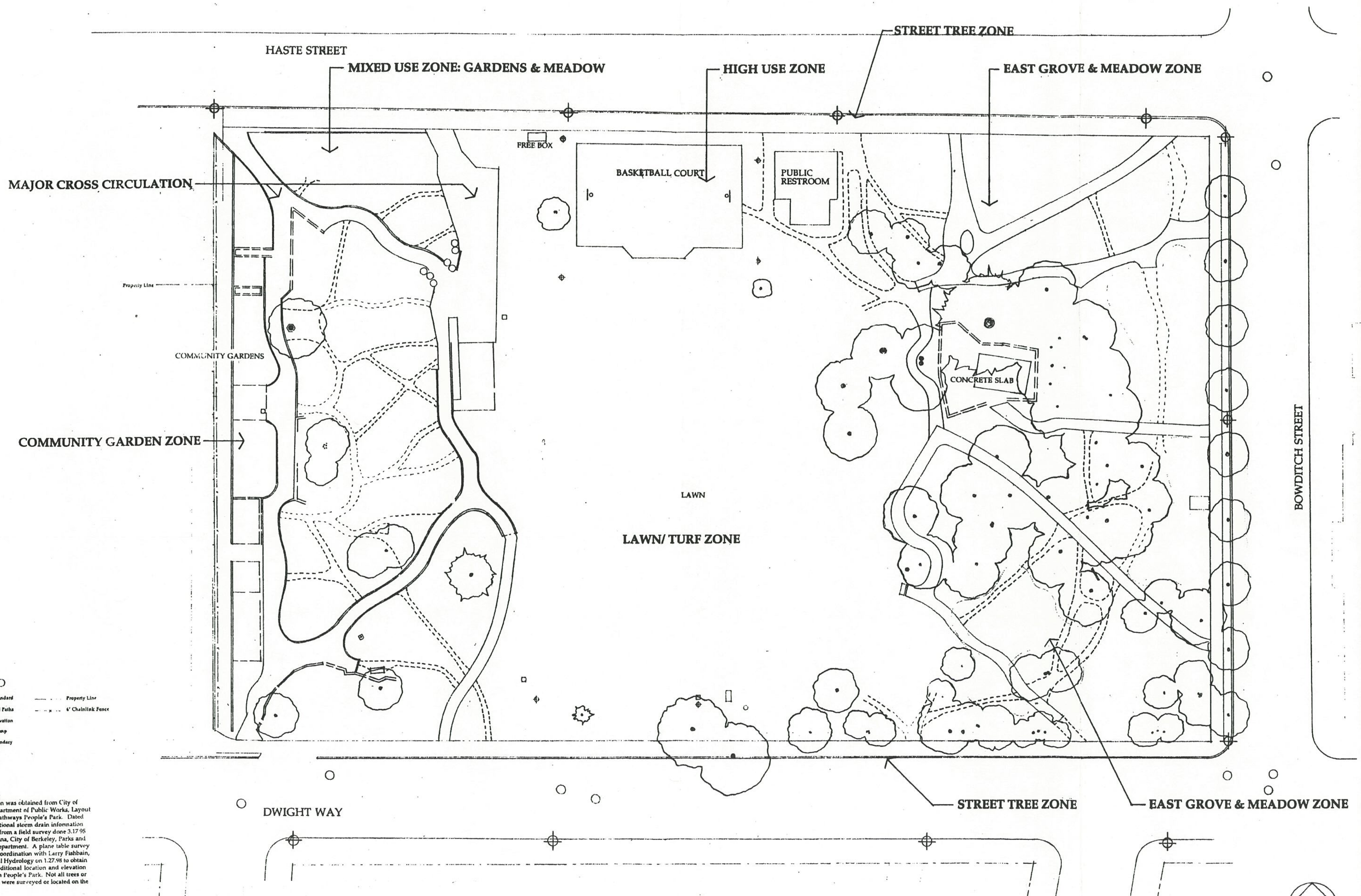

LEGEND

- Light Standard
- Informal Paths
- Spot Elevation
- Tree Stump
- Log Boundary
- Tree
- Header
- Property Line
- 6' Chainlink Fence

Survey Notes:
All information was obtained from City of Berkeley, Department of Public Works, Layout Plan. West Pathways People's Park. Dated 3.29.94. Additional storm drain information was obtained from a field survey done 3.17 95 by Lisa Caronna, City of Berkeley, Parks and Waterfront Department. A plane table survey was done in coordination with Larry Fishbain, Environmental Hydrology on 1.27.98 to obtain and verify additional location and elevation information in People's Park. Not all trees or park elements were surveyed or located on the park plan.

Note: Net post and header footings from former volleyball courts were abandoned in ground. See sheet

Existing Conditions, People's Park

REVISIONS	BY

FIGURE 1

PEOPLE'S PARK
EXISTING CONDITIONS

6.20.1998

1. Background, Purpose and Process of this Feasibility Study

In October of 1997 Wolfe Mason Associates, Inc. (WMA) was contracted by the University of California as a technical resource to the People's Park Community Advisory Board. WMA's charge was "...to give physical form to the elements of the plan [the Conceptual Long Term Plan for People's Park, dated November 2, 1995] and prepare documents to implement the plan." With this charge, it was determined that the first task should be to examine and explore the issues surrounding the restoration and 'daylighting' of the North Fork of Derby Creek within the park, as restoration might impact other elements and components of the conceptual plan, as well as the park itself.

Wolfe Mason Associates, Inc. and Waterways Restoration Institute would like to acknowledge the Citizens of Berkeley, the People's Park Community Advisory Board and its members, the City of Berkeley's Staff and the University of California, Berkeley's Staff for their help and cooperation in the development of this report.

Therefore, the goal of this feasibility study was to objectively explore impacts on the park of a restored creek - its channel and banks - in light of the diversity of issues and concerns of the community, the City of Berkeley and the University of California. The study summarizes the investigation process and the initial findings of the hydrologic studies and design explorations, done by WMA in coordination with the Waterways Restoration Institute (WRI). The findings also identify additional information which may be needed to arrive at a decision regarding restoration. Thus, this report is intended to aid in the discussion and decision making process for the potential restoration of Derby Creek within People's Park.

To assess the feasibility of restoring Derby creek in People's Park one has to answer certain basic questions and look at a series of inter-connected factors, including: Did the creek ever run through the park? What is the watershed's history? What kind of flows could a restored channel expect? Would maintenance and safety be significantly impacted? This study examines such questions, and others. It has been prepared with reference to existing documents, hydrologic data specific to Derby Creek, analysis of stormdrain pipe capacities and elevations, current and historical park elements and use patterns, and both vegetation and drainage patterns within the park.

The Waterways Restoration Institute was responsible for the preliminary research and data collection regarding hydrology and hydraulics.[1] This

[1] See Appendix A *Report to Wolfe Mason Associates, Inc.: Preliminary Creek Restoration Design and Feasibility for Derby Creek at People's Park, Berkeley, CA.* February 6, 1998

information was derived from examination of watershed maps, City of Berkeley stormdrain/ sewer maps and field measurements, existing reference material (photos, interviews with Oakland Museum and city staffs, maps), estimates of magnitude and frequency of open channel flows developed from Rantz', Mannings' and Rational Method equations and estimates of culvert head losses derived from Darcy equations. Calculations based on established regional relationships produced a series of typical geometric cross-sectional and meander belt diagrams reflective of the location and size of the watershed. These diagrams were then translated by WMA into design options so as to further assess the impacts, opportunities and constraints which would in turn effect the overall feasibility of a restoration project. Using overlay methods, WMA looked at current spatial arrangements, existing trees, circulation routes, and existing utilities in and around the park, in order to focus the range of options. This method was also used to reveal points of interest and conflict with other proposed or existing elements within the park.

Given these design options, WMA and WRI, worked to evaluate their impacts both in and out of the park so as to present a single 'best option' for consideration. This best design option was then used to determine feasibility with respect to the expected impacts as a result of a creek restoration. Preliminary cost estimates for a restoration project were subsequently developed.

Water is one of Nature's most powerful elements and must be treated with respect. Ann Riley of Waterways Restoration Institute notes that, 'daylighting' describes the process of excavation and restoration of a stream channel which had previously been culverted and buried. True restoration, or 'daylighting' of a creek starts with science: hydrology, geomorphology and biology. Then the functional requirements of flood control and storm water management are assessed. From this foundation, restoration becomes more than just a component of a safe storm water management system, it is the re-establishment of a balanced hydrologic system, native plant communities, and erosion control. Alternatively, an engineered channel with landscaped banks becomes an artificial water feature within a site. While engineered projects can bring water to a place these alternatives force water through highly controlled conditions which fail to recognize and support the wealth and richness of riparian systems.

2. Technical Findings

The Historical Meander of Derby Creek

The first pertinent issue is did Derby Creek actually run through what is now People's Park? Based on historical maps and photographic records, the information is inconclusive. The most convincing, compelling and affirming answer is a research project conducted by the Oakland Museum to identify the historical locations of East Bay creeks.[2] A map produced by the City of Berkeley, Department of Public Works, also suggests that the creek ran through what is currently the park.[3] In both cases, the reach of the creek is suggested to have entered the Park near the current intersection of Bowditch and Haste streets and run west, southwest to the current corner of Telegraph and Dwight. On the other hand, there have been some recent mapping efforts which suggests the creek may not have been located on the current park site.[4]

[2] Sowers, Janet M. *Watershed Ma of the Oakland-Berkeley Area.* Th Oakland Museum. 1993 revised 1995

[3] *Berkeley Creeks.* Map prepared by Department of Public Works, Engineering Division, City of Berkeley. Revised 1972.

[4] UC seismic study. *Conversation with David Duncan, Senior Planne and Project Manager for UC Seismic Study. April 14, 19978*

A search of historic photographs was also inconclusive. A photograph dated 1930 was of poor quality given the photographic technology and techniques. Another photograph, dated 1947, revealed that the creek had been buried by 1947 and the area completely urbanized. Interestingly, during construction of the former volleyball courts, work crews hit water just three feet below ground. This is evidence of a high water table in the Park. Given this evidence it is not unreasonable to say that the creek did, at some point, run in the area of People's Park, although it's exact location has not been determined.

Hydrology and Hydraulics

Waterways Restoration Institute's report, undertaken for this feasibility study, represents the most up-to-date and detailed hydrology and hydraulics for this section of Derby Creek. Their report suggests that from the standpoint of hydrology and hydraulics, a restoration is feasible.

As indicated in the report the total drainage area for the restoration area is 0.23 square miles. This drainage area is defined by two stormdrain service areas, one is 0.15 square miles the other 0.08 square miles. These two stormdrains connect under the Dwight Way/Telegraph Avenue intersection. One stormdrain is a 20"x 30" Reinforced Concrete Pipe (RCP) culvert running east to west under Dwight Way (B System). A second 39" RCP culvert serves a small area northeast of the park (A System). A dye test done by Waterways Restoration

Institute in coordination with the City of Berkeley, Department of Public Works revealed the flow in the existing combined system for a one in ten year recurrence interval estimated at 100 cubic feet per second. Dye tests are done in order to measure flow capacity of a stormdrain system. First a cross-sectional area of flow within a pipe is determined, then by depositing a small amount of dye into the flow and measuring the time over a controlled distance the velocity is measured. This flow represents the maximum proposed flow in the restoration channel. The stormwater flowline is estimated to vary between 8 and 12 feet below the street surface. Along with existing on-site runoff, these stormdrains would be a restored creek's water source. Regional landscape/hydrological relationships established by Dr. Luna Leopold for drainage area, bankfull dimensions[5] and 50 year flood events were used to assess the feasibility of a restored stream meander corridor, or belt. Calculations based on these established regional relationships produced a series of typical geometric cross-sections and a meander belt reflective of the location and size of the watershed. (FIG. 2 and 3). Typical cross sections and meander sequences were developed for all restoration scenarios. The bankfull channel for the preferred option is estimated to be 6 feet wide within a 22 foot floodplain and have a total project width of 82 feet.[6] The project would involve sloped banks from existing grades down to the channel. The total project width could conceivably be reduced if less conservative estimates were to be employed for the hydrologic calculations. The proposed channel configuration as seen in the cross sections is not representative of the type of channel normally found in a non-urbanized undisturbed condition (B channel).[7] The elevation relationships for the channel developed for this study are more reflective of the channel condition (C channel) found lower in the watershed. This was done for two reasons: 1) to increase channel capacity and 2) to build hydrostatic head at the stormdrain inlet.

Several hydrologic restoration options were developed and explored. Some prove feasible such as that outlined above, others do not. The first option explored was a confluence option: two openings, one at Bowditch and Haste streets and another at Bowditch Street and Dwight Way crossing diagonally through the tree grove to a confluence point at the east end of the lawn. This option would provide the maximum amount of restored creek channel (FIG. 4). However, the confluence option was found to harbor hydrologic and hydraulic

[5] Bankfull channels are defined by storm events that occur once every one and a half to two years and have the most influence on the channel character. See FIGURE 3 entitled *Derby Creek Feasibility: People's Park Cross Section Diagrams* for representation of a bankfull channel. Riley, Ann. *Restoring Streams in Cities. Washington D. C.: Island Press, 1998. Page 122.*

[6] see FIGURE 2 entitled *Derby Creek Feasibility: People's Park Meander Design*

[7] Channel classifications derived from D. Rosgen, *Applied River Morphology*, Wildland Hydrology, 1966.

conflicts.[8] In addition, it was initially believed that a particular hydraulic issue of headloss would be created by the opening of the stormdrain in order to divert water to a confluence restoration design. Early indications were that such a confluence restoration design would require the building of hydrostatic head at the re-entry to the stormdrain system as stormdrain systems operate under pressure in order to pull water through the pipe more efficiently. When the stormdrain line is breached it requires a certain amount of pressure to be built up again in order to draw the water back into the piped system. If applicable, it would mean designing a retention basin at an inlet with a confluence restoration design. Upon further inspection it was determined that this headloss issue only becomes a factor in cases of high flows (greater than 300 cubic feet per second) which are not likely to occur within this system. The confluence option was abandoned as not feasible because of significant grade differences between the two proposed reaches and the necessity of removing upwards of 80% of the trees in the east grove if the confluence restoration design were to have been proposed and implemented.

[8] see FIGURE 4 entitled *Derby Creek Feasibility: Conceptual Creek Restoration Plan - Confluence.*

A second option which connects from the Bowditch Street/ Dwight Way intersection proved more feasible. Water from both systems still could be diverted to allow for adequate dry season flow and only a few trees in the east end tree grove would have to be removed (FIG. 5).

Storm water management is a crucial hydrologic issue to any potential creek restoration project. If the creek is restored, it must function as an integral part of the municipal storm water management system, that is it must transport stormwater runoff at a calculated rate of flow to diminish flood potential. To determine if the restored creek provides adequate storm water conveyance specific hydrologic factors relevant to flood potential were identified and evaluated in this study. Unlike stormdrain systems, which are typically designed to carry the capacity of a 10 year event or less, open channels are usually required to carry, at a minimum, the runoff from a 100 year storm event. The preferred option channel outlined above is designed to accommodate a 100 year, or greater, storm event.[9] In fact, preliminary studies show that a 400 year storm event to potentially be accommodated within the restoration channel.[10] Therefore the preferred design option could actually convey more water than the existing stormdrain culvert.[11]

[9] A 100 year storm is a storm with the statistical likelihood of occurring 1 time in 100 each year. It is derived from historical hydrologic records.
Riley, Ann. *Restoring Streams in Cities. Washington D. C.: Island Press, 1998. Page 122.*

[10] see WRI report, Attachment E

[11] see FIGURE 5 entitled *Derby Creek Feasibility: Conceptual Creek Restoration Plan*

Most East Bay creeks are intermittent with low to very low summer flows. A creek with a perennial, or summer flow, is considered an additional benefit. There are indications that Derby creek may naturally be perennial. It appears there is adequate water to restore and develop a perennial stream. Nearby Strawberry Creek is perennial and interviews of Berkeley residents indicate upstream summer flows on both forks of Derby Creek. Additionally, the WRI report notes that dry season runoff from landscape irrigation and other outdoor residential water use often supplements seasonal low flows.

Utilities

Anytime that earth is excavated the possibility of encountering buried utilities or other objects is high. This is why it is required that Underground Alert be contacted before initiating any excavation. Both the existing on site utilities and new utilities required to connect a restoration to existing infrastructure and stormdrain systems were examined. Our analysis of utilities indicates that existing electrical conduits, light standards, water lines and phone lines are all located within the park. After review with utility companies (PG&E, EBMUD, cable TV, Pacific Bell Telephone) we believe that only the electrical utilities would conflict with the preferred restoration option, requiring that they be relocated within the Park. No gas lines appear to exist on the proposed restoration site according to Patrick Page, an associate distribution engineer with PG&E.[12] The water lines in the park lie outside of the proposed restoration site. Several concrete footings from the former volleyball courts have been abandoned and left buried on site. These footings do not present a major problem if their removal is deemed necessary.

[12] Telephone and fax interview with Patrick Page, associate distribution engineer for PG&E. February 17, 1998.

As mentioned, certain electrical conduits, a control box, and two light standards would be impacted. These are located on the south side of the park on the proposed restoration site. The 6" electrical conduit could be abandoned and moved elsewhere so as to access the park facilities at a different location. The control box and light standards could also be relocated to other sites outside of the proposed restoration site. Still another option is to move the south edge of the project further into the park and thereby leave the control box and light standards in place. In this way the site could retain the existing utilities, specifically the control box and light standards, although this would impact up to 20' of additional lawn open space (FIG 8).

Because the existing stormdrains would be the primary source of water for the restoration, modifications would need to be made in order to redirect water from the existing system into the park and restoration channel. This would involve accessing the existing line and installing a connection and a new culvert from the manhole in Dwight Way to the new channel in the park. Understandably, the creek flow would also require the same to return to the stormdrain system further west on Dwight Way. This inlet would also involve the design and construction of new headwalls at both open ends of the culvert in the park. The detailed specifics of these storm drain connections would need to be further engineered and designed as an aspect of the restoration. Our research shows no other impacts or conflicts pertaining to utilities due to the restoration of the creek.

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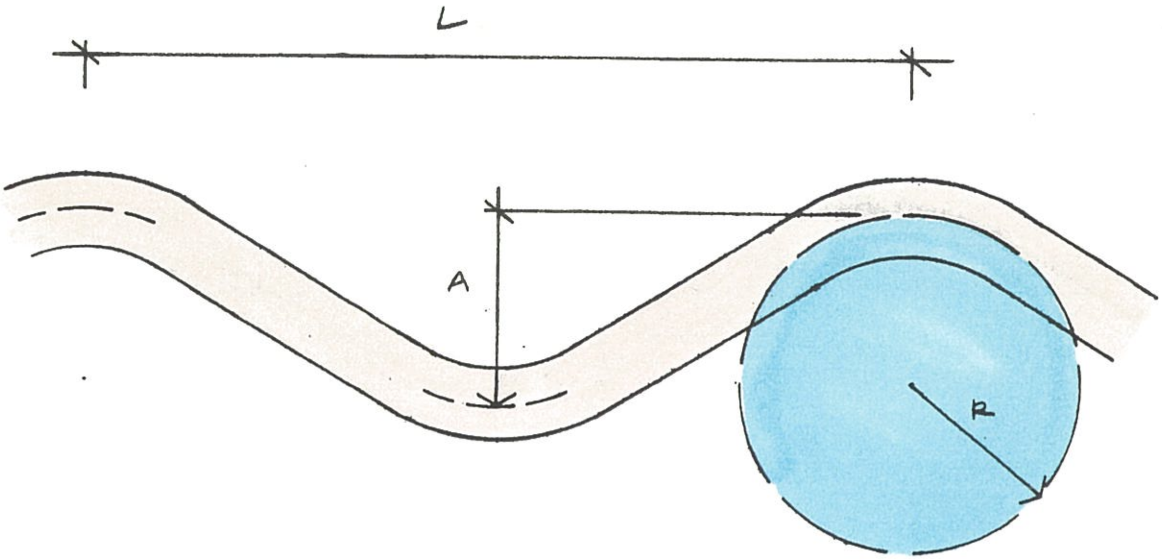
Derby Creek Feasibility, People's Park
Meander Design for Total System



WIDTH (BANKFULL)	6'-0"
LENGTH	66'-0"
AMPLITUDE	16'-0"
RADIUS	14'-0"
PROJECT WIDTH	82'-0"
MEANDER BELT	28'-0"

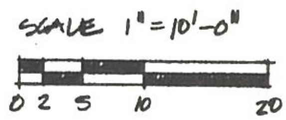
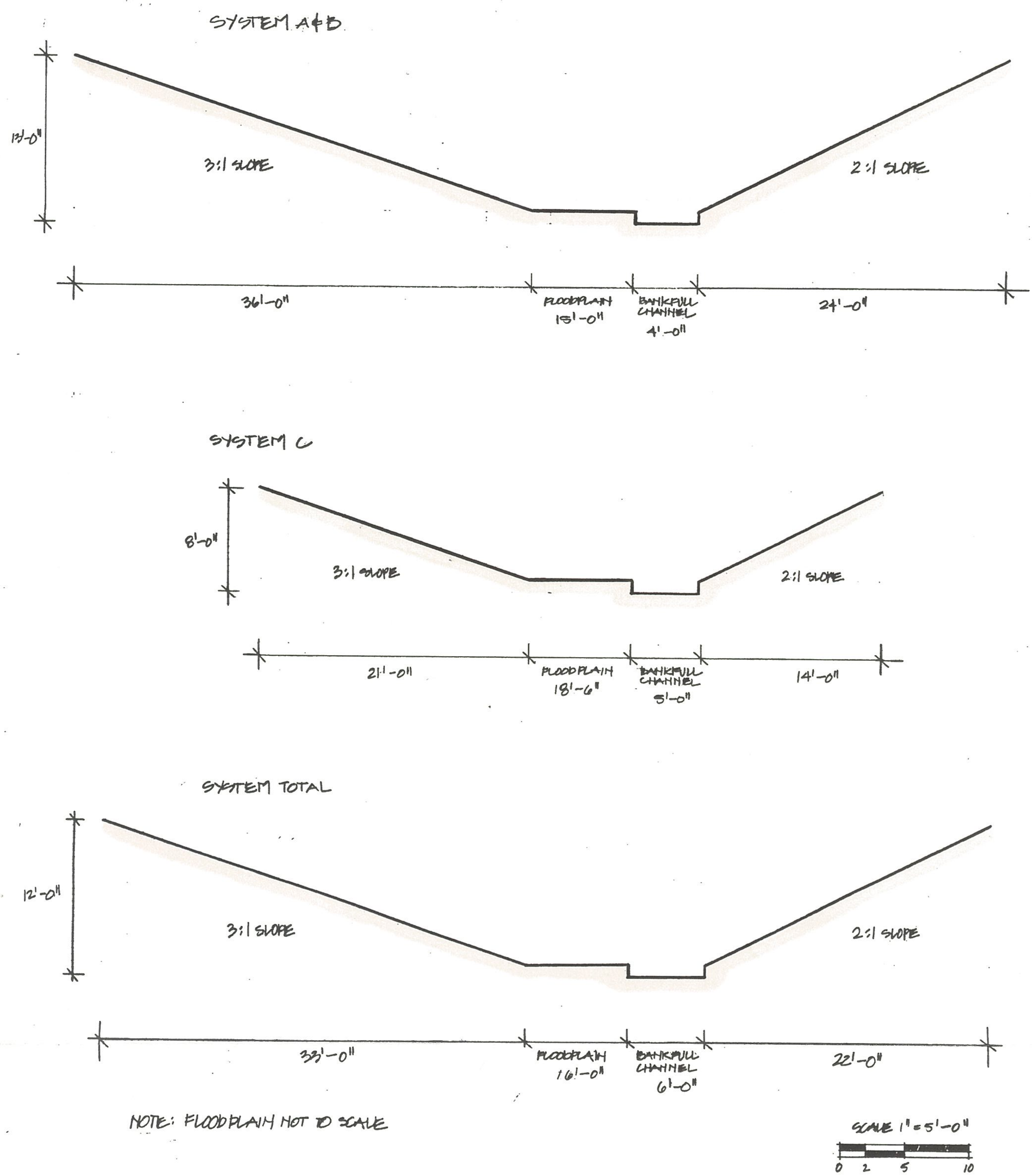


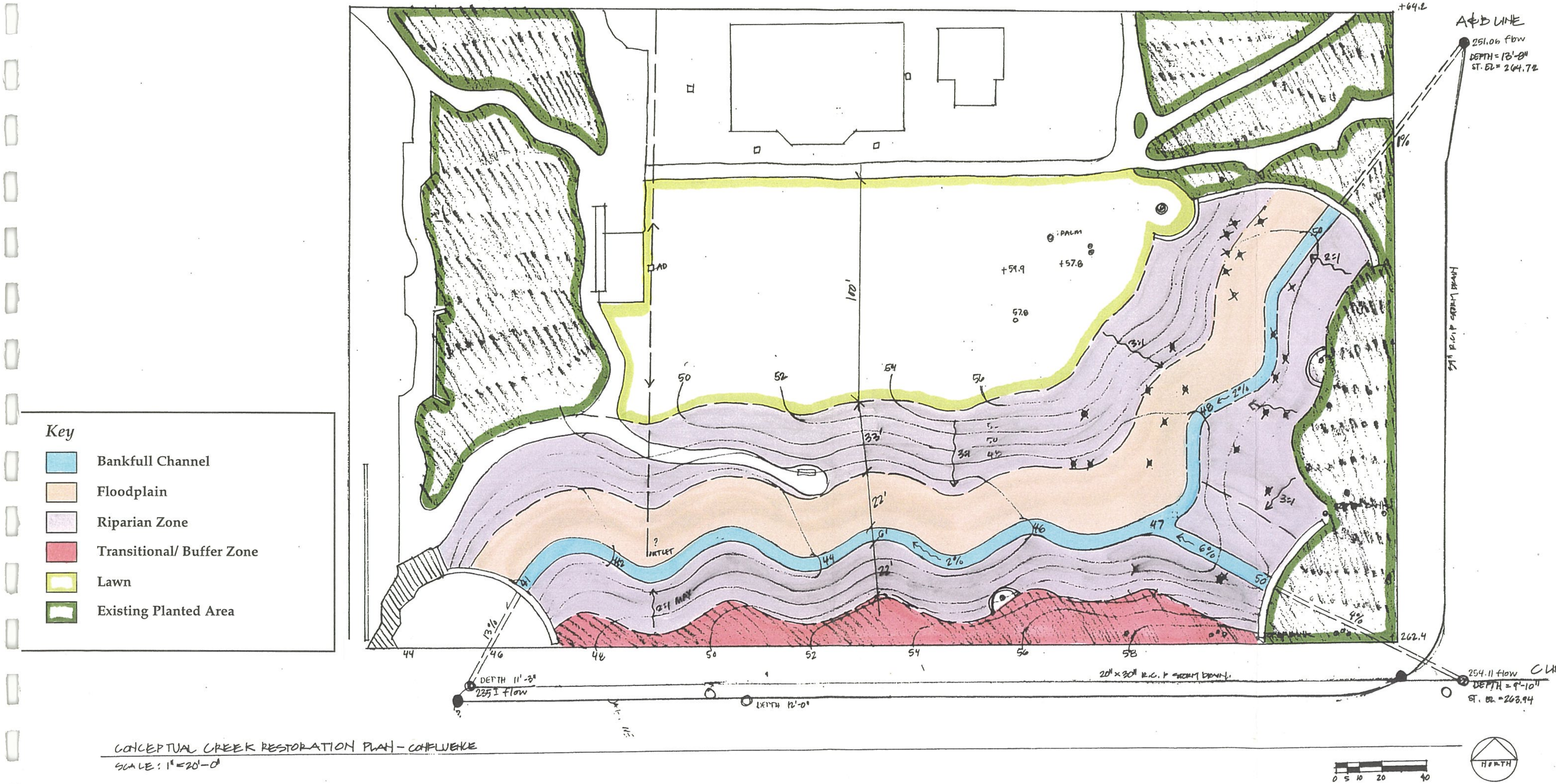
FIGURE 2

PEOPLE'S PARK
MEANDER DESIGN



PEOPLE'S PARK
CHANNEL CROSS SECTION DIAGRAMS

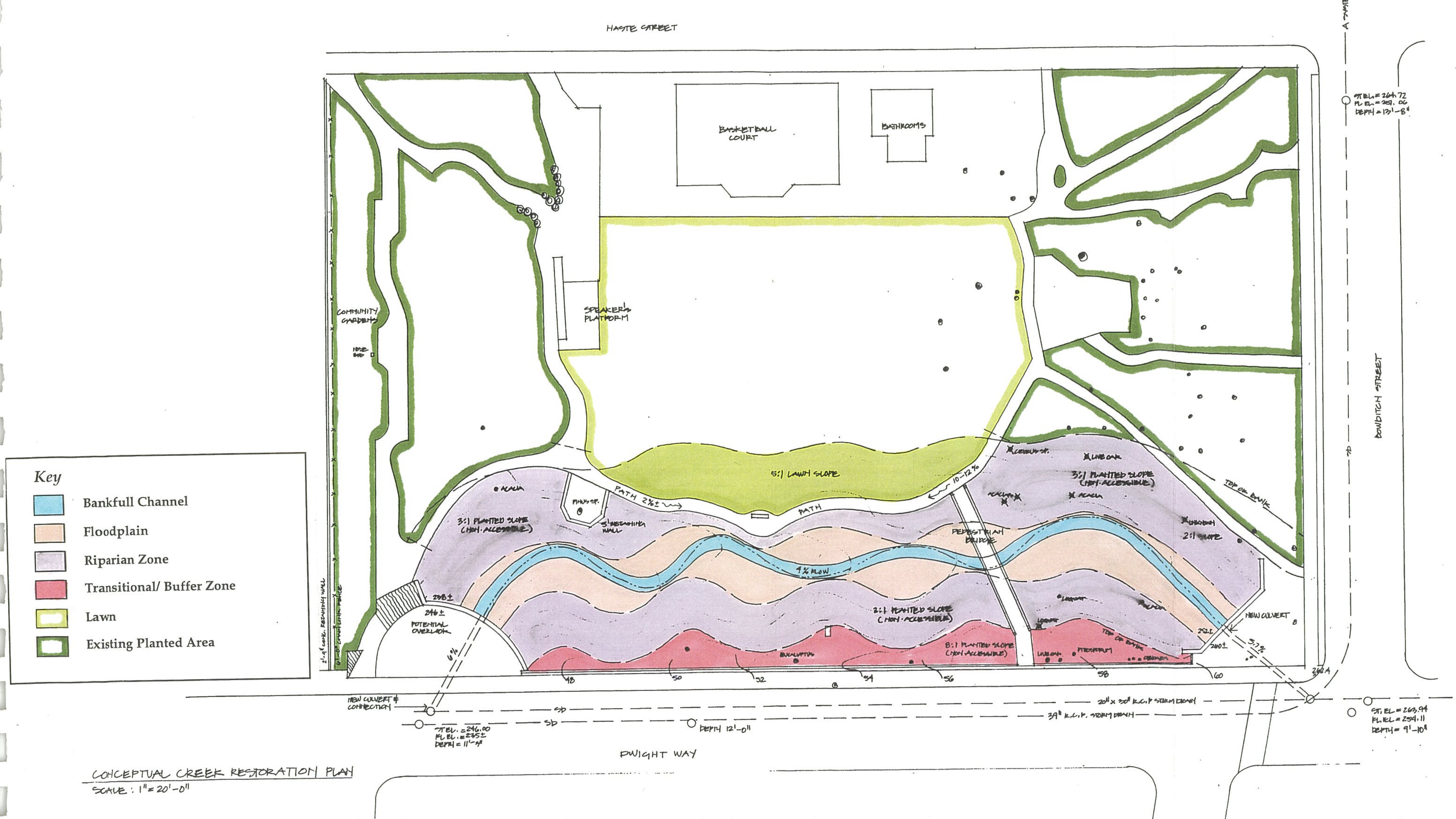
FIGURE 3



<u>*Derby Creek Feasibility, People's Park. Conceptual Creek Restoration Plan - Confluence*</u>
Wolfe Mason Associates, Inc. 1.22.98

FIGURE 4

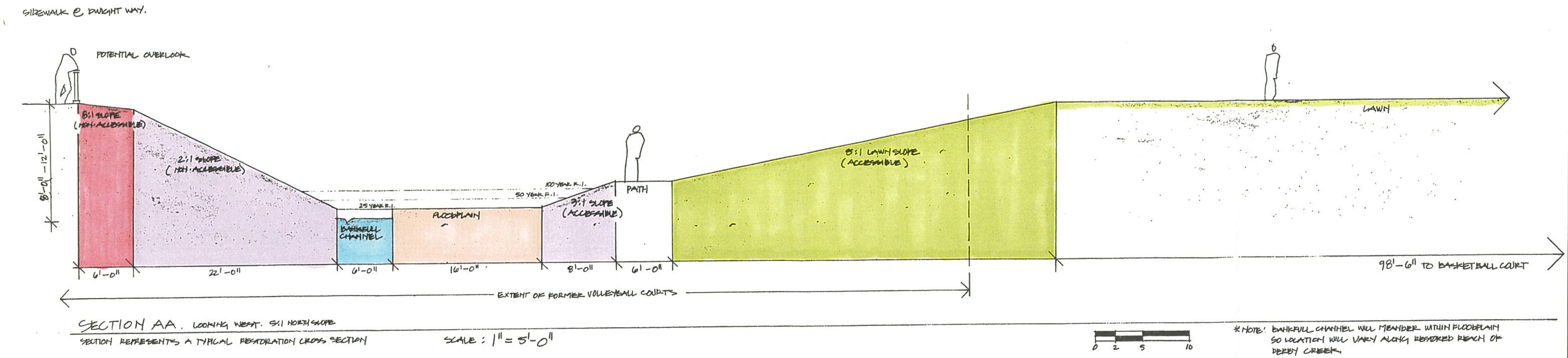
PEOPLE'S PARK
CREEK RESTORATION - CONFLUENCE



Derby Creek Feasibility, People's Park. Conceptual Creek Restoration Plan
Wolfe Mason Associates, Inc. 2.10.98

FIGURE 5

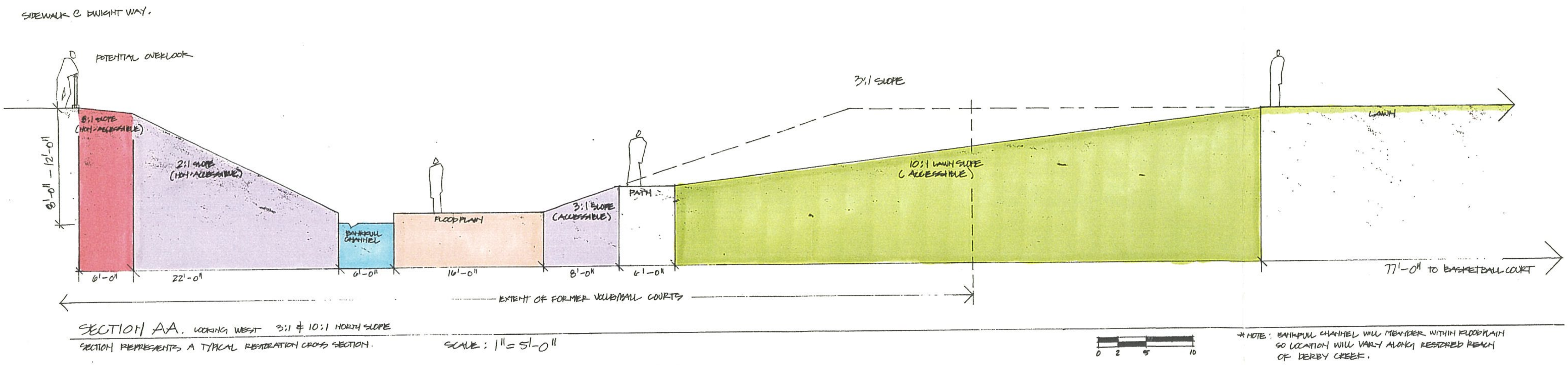
PEOPLE'S PARK
CREEK RESTORATION - CONCEPT PLAN



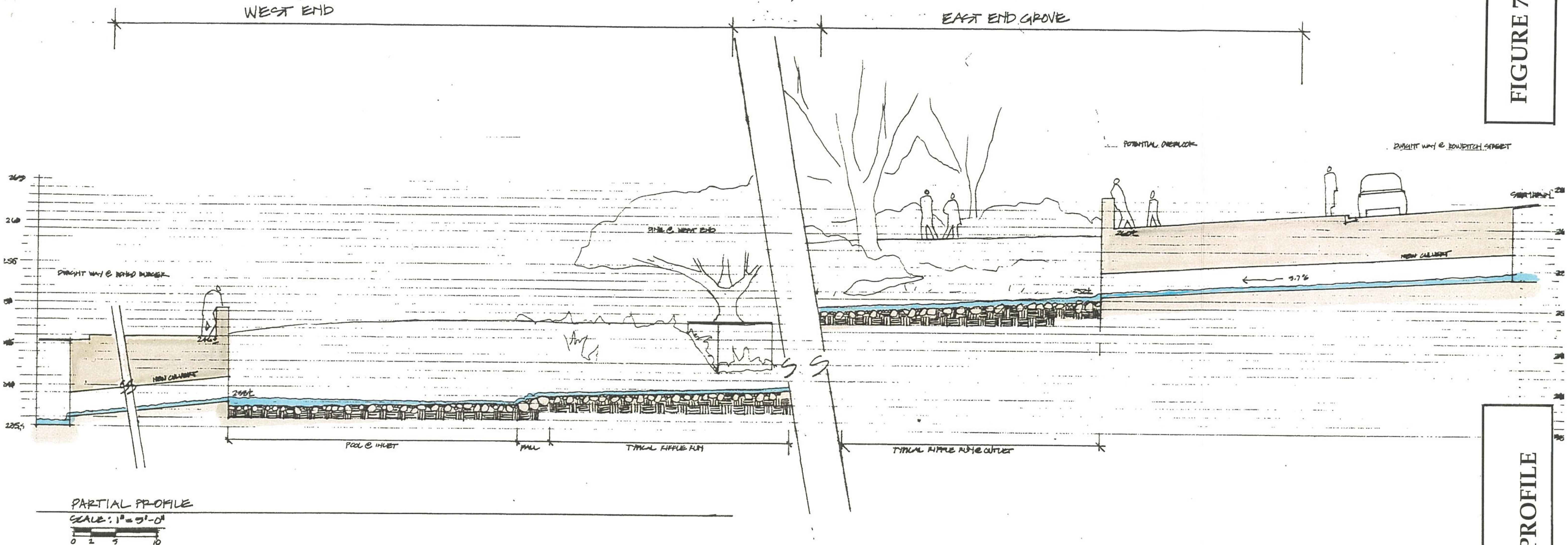
DERBY CREEK FEASIBILITY

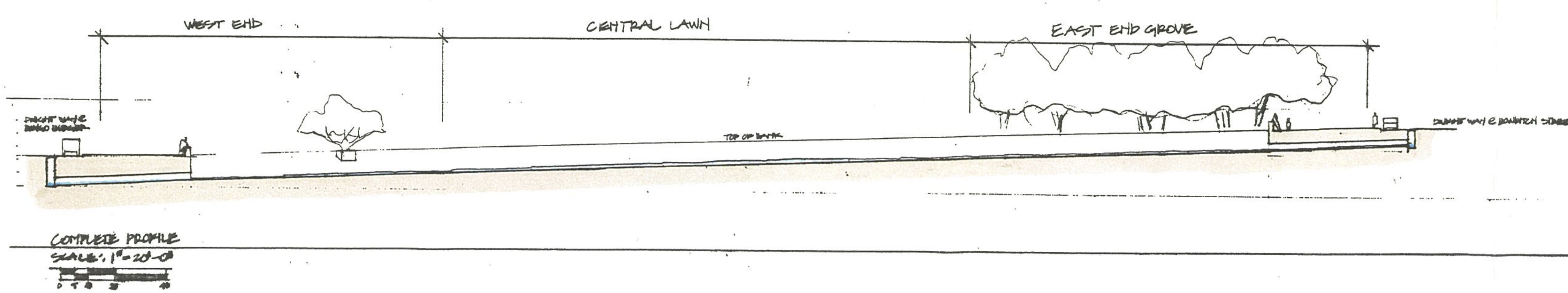
WOLFE MASON ASSOCIATES, INC

2.10.98



Derby Creek Feasibility, People's Park. Cross section Diagrams
Wolfe Mason Associates, Inc. 2.10.98





Derby Creek Feasibility, People's Park. Profile

Wolfe Mason Associates, Inc. 2.10.98

FIGURE 7

PEOPLE'S PARK

CREEK RESTORATION - PROFILE

6.20.1998

3. Issues

Circulation

A creek restoration would have significant, but not adverse, impacts on circulation in the park. Restoration is in this regard feasible, as we do not expect any permanent or major impacts on existing circulation. Since the restoration is contained entirely within the park there would be no permanent impacts on circulation outside of the Park. Changes to circulation would be limited to the area of the park along Dwight Way. Impacted points of entry include paths near the Dwight Way/ Bowditch intersection and at the southwest corner of the park. Unimpeded open circulation into the park from the sidewalk along Dwight Way would also be affected.[13] Other access points and entries to the Park would not be affected by the restoration. As a result of a restored creek channel, access to the park from the south would be focused to the two existing entries and paths at the southwest and southeast ends of the park. A bridge across the channel could be considered as an additional park access point.[14]

Vehicular circulation around the park on Dwight Way, Bowditch and Haste streets would not be significantly impacted as the extent of the project is within the boundaries of the existing park.[15] Some vehicle and traffic disruptions might be expected during the construction of the project particularly when culverts and connections are built to the existing stormdrain system.

[13] see FIGURE 8 entitled *Derby Creek Feasibility: Illustrative Plan*

[14] see FIGURE 9 entitled *People's Park Creek Concept Looking West*

[15] One potential change to vehicular circulation would be the installation of a proposed stop sign and pedestrian crosswalk across Dwight Way near Bowditch. However, this is already under consideration independent of a creek restoration project.

Right-of-way, Easement and Ownership

There are no conflicts with right-of-ways or easements as they are presently defined, as the extent of the creek restoration project is fully within the boundaries of the park.

The University of California and the City of Berkeley as well as interested community members, would most likely be involved as a cooperative stewards of a restored creek. If the City of Berkeley and the University of California maintain or extend their contracted maintenance agreement, the City would probably be responsible for certain aspects of the restoration's management. Because the project would involve connecting to, and coordinating with, municipal stormdrain systems, the City of Berkeley would also be an important part of the project's overall development, review and management.

As the owner of the property which is People's Park, the University of California would retain all the rights and responsibilities conferred to it as the property owner. Any discussions and decisions concerning the implementation of the creek restoration would commence with the legal property owner. The potential restoration project would require the approval and cooperation of the University of California and the City throughout the planning, development, implementation and management process.

California Environmental Quality Act (CEQA)

Before any work on a restoration could be implemented, an initial study would need to be completed and submitted in order to more fully assess the potential environmental impacts associated with the project. The CEQA checklist is an initial study focusing on how the project proposal might impact designated environmental categories.[16] Within each of these categories specific questions and issues are explored in greater depth. A negative declaration from the CEQA report would allow project planning and implementation to proceed. If, however, a negative declaration cannot be issued an Environmental Impact Report (EIR) may be required. An EIR is a more extensive study and report of the proposal, the site, and impacts related to the project.

Landmarks Preservation Commission

People's Park has been given historical landmark status with the City of Berkeley and as a result any potential projects in the park should be approved by the Landmarks Preservation Commission.[17, 18] As the park is the property of the University of California, however, review by the Commission is voluntary and any recommendation is not binding on the University.

[16] The categories of the initial study checklist include Earth, Air, Water, Plant Life, Animal Life, Noise, Light and Glare, Land Use, Natural Resources, Risk of Upset, Population, Housing, Transportation/ Circulation, Public Services, Energy, Utilities, Human Health, Aesthetics, Recreation, Cultural Resources, and Mandatory Findings of Significance. See Appendix B, culled from the City of San Leandro, entitled *Appendix E - (Part 1) Initial Study Environmental Information Form.* April 4, 1989.

[17] Historical landmark status with City of Berkeley, Landmark Preservation Commission for People's Park was conferred on November 19, 1984

[18] Telephone interview with Xandra Grube, City of Berkeley Landmarks Preservation Commission. April 1, 1998.
'The City of Berkeley's Landmarks Preservation Commission requires an application and permit process which includes:

- a written application requesting the proposal be heard by the committee. Committee meetings are held the first Monday of every month.
- a presentation of the proposed park changes. A committee board would then evaluate the proposal in light of the Park's original landmark designation.

Each proposal brought before the commission, and the factors used to evaluate it, are unique and specific. There is no predetermined criteria for evaluation.'

continues on page 21

Derby Creek Feasibility, People's Park. Illustrative Plan
Wolfe Mason Associates, Inc. 4.6.98

FIGURE 8

PEOPLE'S PARK
CREEK RESTORATION - ILLUSTRATIVE PLAN

PEOPLE'S PARK, EXISTING CONDITIONS LOOKING WEST. 4/98

PEOPLE'S PARK, CREEK CONCEPT LOOKING WEST. 4/98

Derby Creek Feasibility, People's Park. Creek Concept Looking West
Wolfe Mason Associates, Inc. 4.8.98

FIGURE 9

PEOPLE'S PARK
CREEK CONCEPT - LOOKING WEST

Maintenance and Safety

As mentioned under the heading of 'Right-of-Way, Easement and Ownership', restored creek maintenance would require a cooperative agreement between the City of Berkeley and the University of California. Maintenance efforts could also likely incorporate community organizations, schools and other interest groups. Primary channel management issues would center on maintaining a clear and open channel. Regular and consistent monitoring would be necessary for the purposes of developing adequate visual access and prevention of obstructions at culvert openings. In particular, during the first few years after installation, the project would require attention and monitoring in order to properly establish vegetation and maintain channel integrity. These maintenance requirements, and the time investment, would subsequently taper off after the five year establishment period. The specific maintenance requirements would include tasks involving monitoring of water flows and bank stability, water quality, desired plant establishment and exotic plant removals, and debris (human and natural) collection. A clear task list and schedule of work would need to be established as well as an agreement designating responsibility.

A creek restoration at People's Park would not likely increase pollution in the park. The water flowing in a restored channel would be the same as that found in the stormdrain system. Therefore we can expect that the creek would contain the same levels of petroleum residue as other and current urban and residential runoff.[19] Sewer line breaks have in the past presented temporary problems for creeks, but this is the rare exception and certainly not the norm. Quick and prominent posting would generally be a sufficient response to alleviate any perceived water quality issue in the park, if indeed it were to happen. Historically, interested citizens become active in regular water quality monitoring programs and creek cleanups around creek restoration projects.

[19] It is worth noting that recent research indicates that petroleum products and their hydrocarbon constituents are naturally attenuated when exposed to organisms found in the soil. Therefore a restored creek would likely increase water quality over water encased in a stormdrain. Craul, Phillip J., *Urban Soil in Landscape Design. New York: Wiley, 1992*

Certain species of urbanized wildlife can also be expected to frequent a restoration project. Rodents, skunks and raccoons might be seen along a restored creek, but as is true in neighborhoods and parks everywhere, these animals rarely present any hazard or danger to humans.

There is a perceived danger of open channels, albeit somewhat unfounded. The general fear of children being swept away to the bay, of homeless encampments and of shrubby areas is often an initial obstacle to creek restoration. In many cases, although these fears should not be dismissed outright, there is very little evidence of actualized dangers or problems.[20] Restoration of creeks actually improve some of these conditions because there are more users and visitors to the site.

In terms of safety concerns arising from visual access issues, both the City of Berkeley and the University of California Police Departments need to be involved in the review and design process. The willows used to restore channels and stabilize banks do go through a brief, shrubby transitional stage which can partially obscure the channel. During this shrubby stage the willows may offer a place for people and their personal belongings to collect and for the deposition of trash. A correctly designed creek planting plan mitigates some of these concerns. The planting plan should include the installation of a fully successional plant group to hasten the stabilization of a new creek channel.[21] This would alleviate some of the willow/view concerns while accelerating the design goal, which is a open clear creek channel shaded by larger canopy trees. Normally, the canopy succession begins to take form within five years.[22] The Urban Creeks Council of California has been conducting regular pruning and weeding of Berkeley creek channel restoration projects to encourage mature canopy formation and prevent early vegetative growth from overwhelming the channel in the first two years.[23]

Impacts on other Park Elements and Uses

A restoration project would likely impact, to some degree, existing park uses, including special events and programs such as the children's recreation program. Due to the location of the potential project, the impacts to other park elements and uses are expected to happen within an area about 82 feet wide adjacent to Dwight Way. Examination of the former volleyball courts shows that the north-south width of the proposed creek restoration roughly fits into the space once occupied by the courts. This suggests that the project impacts would likely reflect the physical impacts the volleyball courts once imposed. Existing recreational use of the central lawn area would not be significantly impacted. An expansive lawn area 120 feet x 160 feet would be retained in the restoration plan.[24] The south end of the community gardens would not be impacted by the project. The most impacted area would be the edge along Dwight Way and the southeast and southwest corners of the park. The excavation of soil (roughly

[20] Since the restoration of Strawberry Creek in 1984 through Strawberry Creek Park in West Berkeley, no known instances of injury resulting in hospital visits have occurred.

[21] A fully successional plant group is one that includes plants selected from each stage, or seres, of normal ecological development and planted at the same time to accelerate seres progression.
Sauer, Leslie Jones ''Managing Succession' in *The Once and Future Forest: a guide to forest restoration strategies.* Washington D. C.: Island Press, 1998

[22] see FIGURE 10 entitled *Change in Channel Character*

[23] Conversation with Carole Schemmerling of the Urban Creeks Council. April 9, 1998

[24] see FIGURE 8 entitled *Derby Creek Feasibility Illustrative Plan*

5000 cubic yards) to establish a channel would impact 6-12 trees in the park, depending on the channel bank grading. The planning and design process could consider these impacts and attempt to minimize tree removal as a result of the restoration effort. The excavation of soil may also require that some soil remain on site, in which case, grading changes would need to be examined. The project could beneficially impact the current drainage problems in the park by regrading to direct on-site water in swales or pipes to the creek.

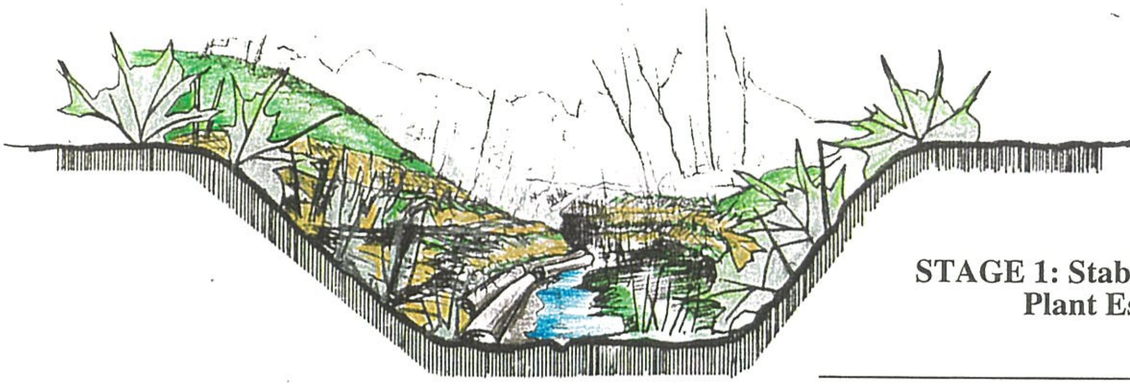
As a next step this restoration would need to address, through the design process, a balance of park uses as well as some of the park's existing concerns and problems. The next element of this feasibility study will be to prioritize other potential physical design elements and projects in the park in order to consider how they may be impacted by or impact the restoration of Derby Creek in People's Park.

The project's edge along Dwight Way could be used to develop a buffer between the park and the residences across Dwight Way [25]. Developing a buffer between the park and activities in the park and the adjacent neighborhood is an issue frequently discussed.[26] This buffer could impact the neighbors beneficially by blocking a degree of sound and light coming from the park. On the other hand, the project may act as a barrier preventing open circulation into the park along Dwight Way. Points of interest and access could be designed into the project to further enhance views and public interactions with the park. A children's play area, for example, could be considered and designed with ADA path access, to create exciting physical and visual connections to a restoration project. The restoration design process is an opportunity to evaluate and encourage participation by residents of the adjacent neighborhoods.

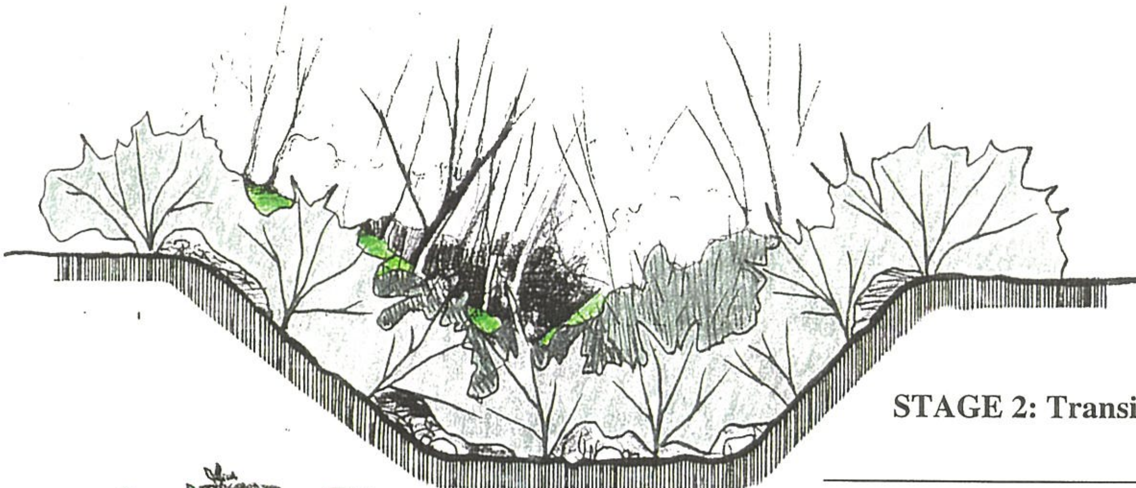
[25] see FIGURE 11 entitled *People's Park Creek Concept Looking East*

[26] see FIGURE 12 entitled *People's Park Creek Concept Looking South*

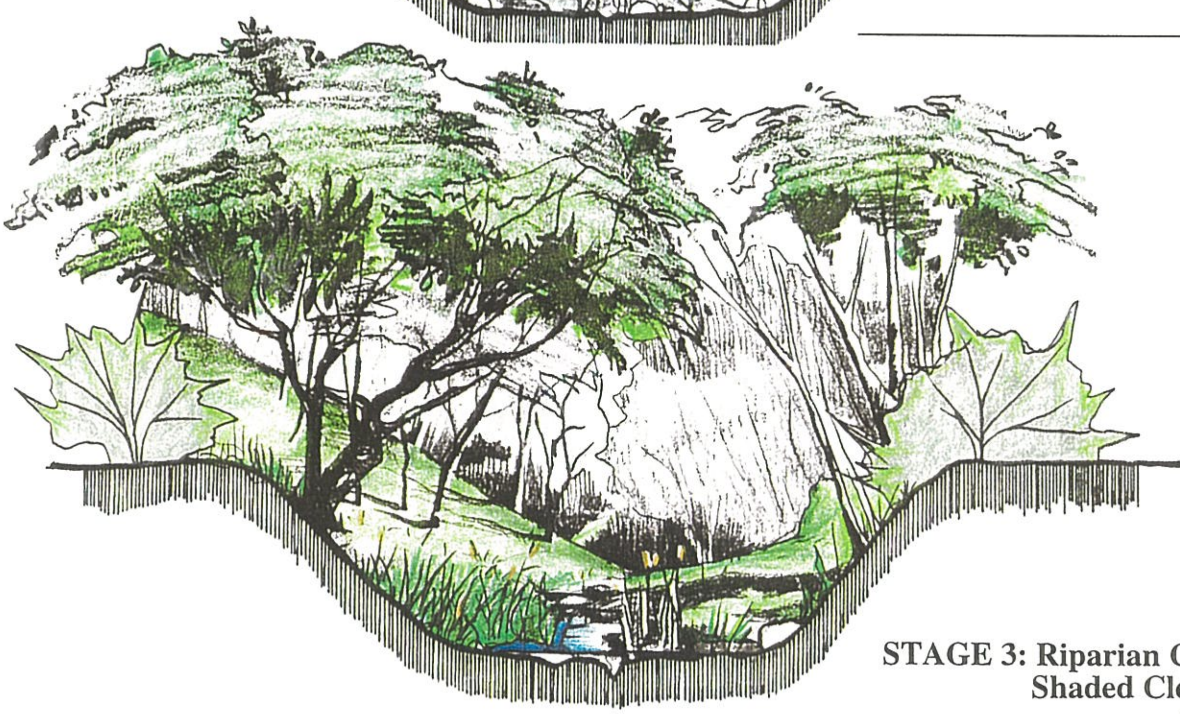
continues on page 26



STAGE 1: Stabilization and Plant Establishment
0 - 2 Years



STAGE 2: Transitional Scrub
2 - 5 Years



STAGE 3: Riparian Canopy with Shaded Clear Channel
5 - 20 Years

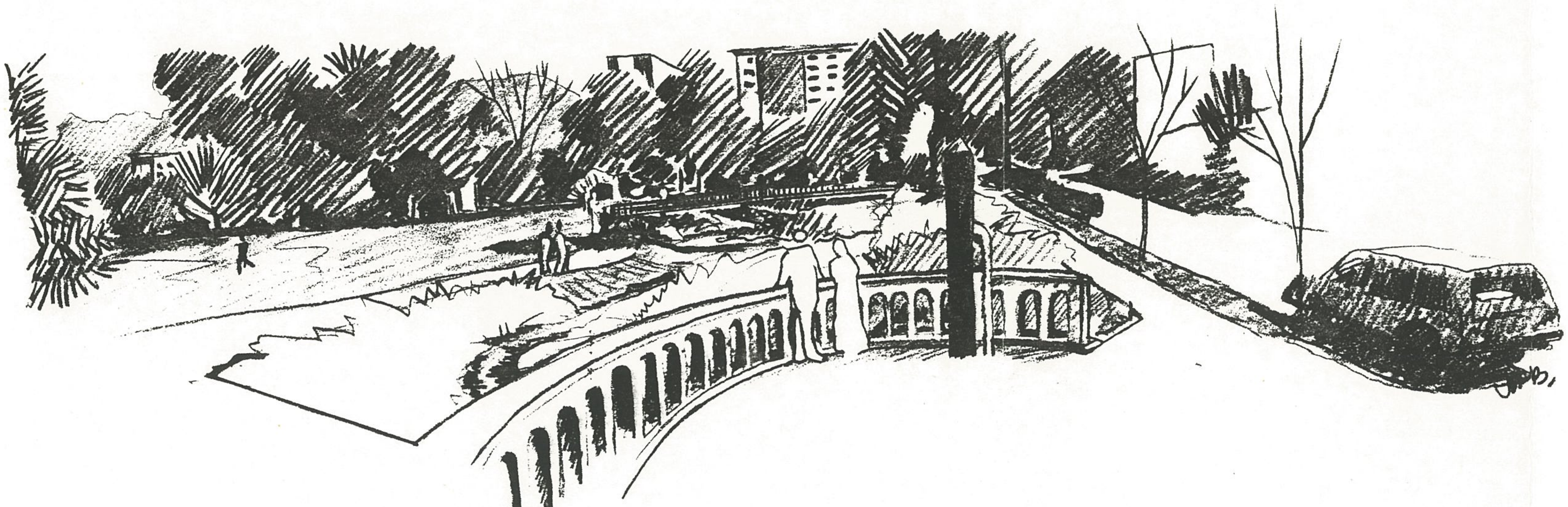
Conceptual Drawings of Change in Channel Character with Age of Riparian Vegetation

FIGURE 10

PEOPLE'S PARK
CHANGE IN CHANNEL CHARACTER

PEOPLE'S PARK, EXISTING CONDITIONS LOOKING EAST.

4/98



PEOPLE'S PARK, CREEK CONCEPT LOOKING EAST.

4/98

Derby Creek Feasibility, People's Park. Creek Concept Looking East
Wolfe Mason Associates, Inc. 4.8.98

FIGURE 11

PEOPLE'S PARK
CREEK CONCEPT - LOOKING EAST

Construction

Like most construction projects, particularly those within the public sector, the implementation process could be complex and detailed. Necessary tasks would need to be outlined and assigned to appropriate personnel i.e. engineers, volunteers, administrators, community groups, contractors and other technical specialists. Skills would need to be identified and matched with the various project requirements. Implementation time and schedules can vary greatly based on a number of factors including design, engineering, review, permitting and construction method. Experience from previous projects has shown that the design, review and implementation process stretches one and a half to three plus years, but the actual construction process could take as little as three months if done at one time by a general contractor. If it was decided that restoration at People's Park was to be undertaken, the process, in general would be as follows:

- Project design and engineering, Community Outreach, Involvement and Feedback
- Project Initiation: Permitting[27] (State Department of Fish and Game, Regional Water Quality Control Board, and US Army Corps of Engineers), site preparation, tree protection, and traffic control
- Demolition: Utilities, tree removal, site clearing, sawcut culverts, bury culverts
- Grading: Soil excavation, stockpile soil, haul soil off site, rough grading
- New Walls and Drainage Structures: New culvert at outfall, new culvert at inlet, new connections at stormdrains, retaining walls at entries
- Creek Finish Grading and Slope Stabilization: coordination between grading and creek layout, finish grade, low and bankfull channels, build pool and riffle runs, import boulders for stabilization and pools, import stone and gravel for creek bed, anchor toe of slope, finish grade banks and stabilize with wattles, erosion control fabric and pole cuttings at banks, initial plantings for stabilization
- Irrigation and Bank Stabilization Plantings: Auto irrigation system for north and south banks, install controller
- Hardscape Construction: Paving at entries, miscellaneous pavement repair, overlook fence along Dwight Way
- Project lighting, signage and interpretation
- Landscape Planting: Trees, shrubs, ground covers, mulching
- Initial Maintenance and Monitoring

[27] Permitting could involve a '1603' California Department of Fish and Game Streambed Alteration Permit, a Section 404 US Army Corps per

Costs/Funding

Creek restoration projects can have a broad range of costs depending on many factors, including: location, physical site constraints, earthwork, utilities[28] and who builds the project. Generally, a large portion of the total project cost is related to infrastructure: additional culvert and pipe connections, abandoning and/or relocating existing utilities. The removal of excavated soil and other materials can be another expense. Cost reduction strategies could be developed to identify tasks which could be carried out by volunteers, community and youth groups, and conservation corps teams. This method generally relies on some additional training and management expenses, but also results in opportunities for community education and involvement.

[28] see *Technical Issues: Utilities* for an expanded discussion of existing utilities issues.

Funding for restoration projects can come from a variety sources. These sources include: the property owner, the City, community and interest groups, and federal, state and county agencies, particularly in the form of grants. All of these resources should be explored in order to establish the necessary funding for the project.[29]

[29] For a preliminary assessment of project expenses and estimated total project cost please see Appendix C, *Detailed Cost Estimate.* This estimate is a 'high end' estimate based upon construction of the entire project by a general contractor hired through a public bidding process

continues on page 29

PEOPLE'S PARK, EXISTING CONDITIONS LOOKING SOUTH.

4/98

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PEOPLE'S PARK, CREEK CONCEPT LOOKING SOUTH.

<u>*Derby Creek Feasibility, People's Park. Creek Concept Looking South*</u>
Wolfe Mason Associates, Inc. 4.8.98

FIGURE 12

PEOPLE'S PARK
CREEK CONCEPT - LOOKING SOUTH

4. How to Decide

It appears feasible to develop and implement a restored reach of Derby Creek within People's Park. A restored creek channel as outlined in this report far exceeds the minimum standards for safe storm water conveyance. A restored channel would work with the existing stormdrain system, although more detailed field work and engineering calculations would need to be carried out to finalize designs for headwalls, additional culverts and the project's physical and hydraulic connections to the existing stormdrain system. A restoration project for Derby Creek would use flows diverted from stormdrains located near the park. A dye test done by Waterways Restoration Institute and the City of Berkeley, Department of Public Works verified flow capacity estimates of 100 cfs for the combined stormdrain system servicing the People's Park area. The project is hydraulically feasible even allowing for a culvert head loss caused by the opening of the stormdrain system as these losses could be redressed with the retention of water within a restored channel. Thus, a restored channel would act as a functional part of the City's stormdrain system. It would be a hydrologically and physically functional system where water moved efficiently and where the creek's banks were a stable and integral part of the channel and park.

The project would develop a 'dynamic equilibrium' within the channel. Dynamic equilibrium is established when a stream's erosion and sedimentation processes continue to take place, but are balanced over time. This significantly reduces future maintenance costs.

A feasible restoration calls for a 6 foot wide bankfull channel which would meander inside a 22 foot floodplain. The total project width is somewhat flexible and would not need to exceed 82 feet. A feasible restoration project, as presented here, fits within the north-south footprint of the former volleyball courts.[30] There are opportunities for a variety of bank and slope conditions which could respond to community, City, and University desires and concerns, in particular, issues of circulation, maintenance and safety.

[30] see FIGURE 8 entitled *Derby Creek Feasibility Illustrative Plan*

Calculations and restoration scenarios have been undertaken to integrate conservative estimates for pipe capacities, runoff potential and frequency, and storm events. The findings of this report reflect these estimates and suggest that there is potential to pare down the overall size of the project if less conservative estimates were to be employed.

Political will and cost are the two largest constraints to this potential restoration project: the University of California, the City of Berkeley and the People's Park Community Advisory Board should now review and evaluate this feasibility report and consider its findings particularly in the context of future uses and elements in the park. As outlined in this report, a potential creek restoration project within People's Park will have impacts on the park and its users. As an important part of reviewing the restoration feasibility, other elements and uses in the park should be reviewed and evaluated, in order to develop a cohesive and practical plan for the park. Priorities for future uses and desired park improvements should be determining factors in the review and evaluation of the restoration project's feasibility.

The potential creek restoration in People's Park would have tangible impacts in the park. As outlined in the report, the restoration project would impact the current spatial and use patterns in the park. The central lawn is maintained almost in its entirety as are the southeast and southwest corners of the park. A limited number of trees from the east end tree grove would necessarily be removed in order to develop the creek channel, its banks and circulation around it. While serving as an opportunity for community program development and engagement, the establishment and management of vegetation associated with the restoration will be an intensive and complex aspect of the potential project. Connections to the municipal infrastructure; stormdrains and electricity would require rigorous design and engineering in order to tie into existing systems.

There are opportunities to include and enhance both existing and planned elements of the park. Other issues, such as poor drainage and appropriate park lighting could be incorporated into the park as a result of the comprehensive planning process for a project this size. The potential creek restoration could enhance the educational, aesthetic and environmental components of the park. The dynamic nature of a creek could bring additional diversity and interest to the uses and understanding of the park.

A feasible creek restoration will both benefit and impact People's Park. Some of the expected pros and cons of a potential restoration project may include:

PROS:

- increased activity, interest and focus in People's Park.
- attracting people for lunch or coffee, hosting elementary school students for field trips, engaging university classes, inviting community monitoring and stewardship, and offering a quiet afternoon by the water.
- enhancement of the aesthetic and environmental character of the park. Water is a playful and pleasant element and has historically been used in design projects for contemplation, interaction, and education.
- bringing water into People's Park, and with that, an acknowledged connection to our environment.
- restoration and enhancement of regional or local identity
- opportunity for ecological and environmental restoration
- enhancement of the vibrancy of the Southside neighborhood while incorporating public input, interest and vision and connection to a historical and cultural resource. The park's diversity of uses would likely increase with the a restoration.
- opportunities to acknowledge the necessary integration of our communities to natural systems and to the region as a whole.

CONS:

- impacts to current park use and spatial organization.
- substantial cost and financial investment.
- temporary and permanent changes to circulation in the park.
- reduction of lawn space.
- perceived fear/ perception of encouraging illicit behavior and activity and the creation of potential hiding places.
- increased urban wildlife, such as raccoons, skunks and opossums.
- change.
- complicated inter-agency buy-in between the University, the City, government agencies and the community.
- disruption to traffic and adjacent neighborhood during implementation and project development.
- two to five year transitional vegetation period. During this time the vegetation goes through a shrubby establishment stage where the the willows can obscure views of the creek.

In conclusion, a creek restoration is complex. It requires the vision and cooperation of many agencies and individuals to produce a successful project. As discussed in this report, it is our professional opinion that a restoration of Derby Creek in People's Park is feasible. Implementation, if proposed, would require fundraising, permitting, project design development, community outreach, feedback and coordination, detail design, construction drawings, and bidding procedures. There would necessarily need to be agreements developed by the respective interests, including the community, the City of Berkeley, and the University of California. Coordination between such stakeholders would need to be organized.

Appendix A

Waterways Restoration Institute Report:

Report to Wolfe Mason Associates, Inc.: Preliminary Creek Restoration Design and Feasibility for Derby Creek at People's Park, Berkeley, California

Submitted by Ann L. Riley and Drew Goetting

February 6, 1998

WATERWAYS
RESTORATION INSTITUTE

1250 Addison Street #107 ~ Berkeley ~ California ~ 94702 (510) 848-2211 Fax (510) 848-2219

To: Gary Mason
Wolf Mason Associates Inc.
2036 Emerson St.
Berkeley, CA 94703

From: A. L. Riley, Drew Goetting, Dan Szumski
Waterways Restoration Institute
1250 Addison St. #107
Berkeley, CA 94702

Date: February 6, 1998

Project Design Methods

The data used in this report are derived from watershed maps, Berkeley storm drain sewer maps and field measurements, estimates of magnitude and frequency of open channel flows (Rantz', Mannings' and rational method equations) and estimates of culvert head losses (Darcy equation). Regional relationships established by Luna Leopold on drainage area and bankfull dimensions and on 50 year stages are used to design the restoration cross-section. Averages established between channel widths and meander geometry are used to design the required stream meander belt.

Preliminary Conclusions

A restoration creek channel for Derby Creek could use flows diverted from one or both storm water culverts near the intersection of Bowditch and Dwight Way. Some dye velocity measurements should be taken for the larger storm water culvert to confirm estimates of pipe capacity. The project is feasible from a hydraulic standpoint because culvert head losses are acceptable given our ability to easily retain large storm flows in the existing culvert if necessary. An equilibrium restoration creek, which will neither develop erosion or sedimentation problems can be created within a 22 foot wide floodplain corridor width a total project with area which will not exceed 82 feet. It is feasible to provide a restoration channel design which will not create flooding in the park or streets in the vicinity. Further field data is required however to finalize the design of the culvert connection desired to make the storm water diversions to the new restoration channel.

Leopold B. Leopold, A View of the River, Harvard University Press. 1994

S.E. Rantz, San Francisco Bay Regional Environment and Resources Planning Study, U. S. Department of the Interior, Geological Survey. 1971

Thomas Dunne and Luna Leopold, Water in Environmental Planning, F. W Freeman Inc. San Francisco 1978.

Historical Information

The Oakland Museum of California conducted an extensive research project to identify the historical location of the East Bay San Francisco Creeks. The map produced in this project suggests that a northern branch of Derby Creek was located in what is now People's Park (Attachment 1). A map produced by the City of Oakland also puts the historical location of this branch of Derby Creek in People's Park (Attachment 2). In both cases this reach was suggested to have entered the park between Dwight Way and Haste and traveled West Southwest to the corner of Telegraph and Dwight Way. For purposes of this report this reach will be referred to as the North Branch Derby Creek.

A search of historical photographs provided no additional evidence of the North Branch Derby Creek or any other reaches prior to the region's development. The earliest aerial photograph, dated 1930, proved inconclusive due to poor photographic techniques. The next aerial survey was conducted in 1947 (Attachment 3). Photographs from this survey indicates that the region was completely developed to its current condition

Drainage Area and Watershed Characteristics

There is currently only one existing open reach of Derby Creek. This 1,000' channel, located in the upper most portion of the watershed, used to be the middle branch of Derby Creek. This reach is dominated by California Bay(Umbellularia californica) and appears to be in equilibrium. Its historical confluence with the north branch would have occurred below People's Park. This reach now enters the city storm water system at Prospect St. and is carried under Dwight Way passing People's Park on its South border. The total drainage area for this system is approximately .14 square miles.

The North Branch of Derby Creek is entirely culvert. This storm water system drains approximately .08 square miles before it reaches the Eastern border of People's Park along Bowditch St.

The two systems parallel each other under Dwight Way before joining under the intersection of Telegraph Ave and Dwight Way (Attachment G).

The geometry and characteristics of a channel in a highly urbanized watershed are considerably different from un-urbanized watersheds. These changes are due to the lack of permeable surfaces and result in a shortened lag time between the peak rainfall and the peak channel discharges. There may also be a reduction in the volume of summer or dry season low flows. However this condition is often not observed due to significant dry season runoff from lawn watering, car washing, etc.

The amount of channel flow predicted for these low flows is difficult to assess with out being able to observe or measure culvert flows in the dry season. However, anecdotal information of dry season flows in the middle branch of Derby Creek and upper Strawberry Creek watershed provide an indication for summer low flows.

Hydraulic Considerations

The combined drainage area of the two storm drain systems converging at Bowditch and Dwight Way (including runoff form the park area) is .23 square miles. Calculations used in this report to estimate storm discharges and restoration channel dimensions are based on this large number to make our design assumptions as conservative as possible. Diverting flows from only culvert A (Attachment G) would reduce the drainage area to about .15 square mile. This may be the least expensive and most practical design option. If field measures of storm culvert velocities give us higher velocity estimates than 16 feet per second at culvert capacity, then a

T-shape culvert diversion pipe should be used to convey only a portion of the high storm flows down the restored channel.

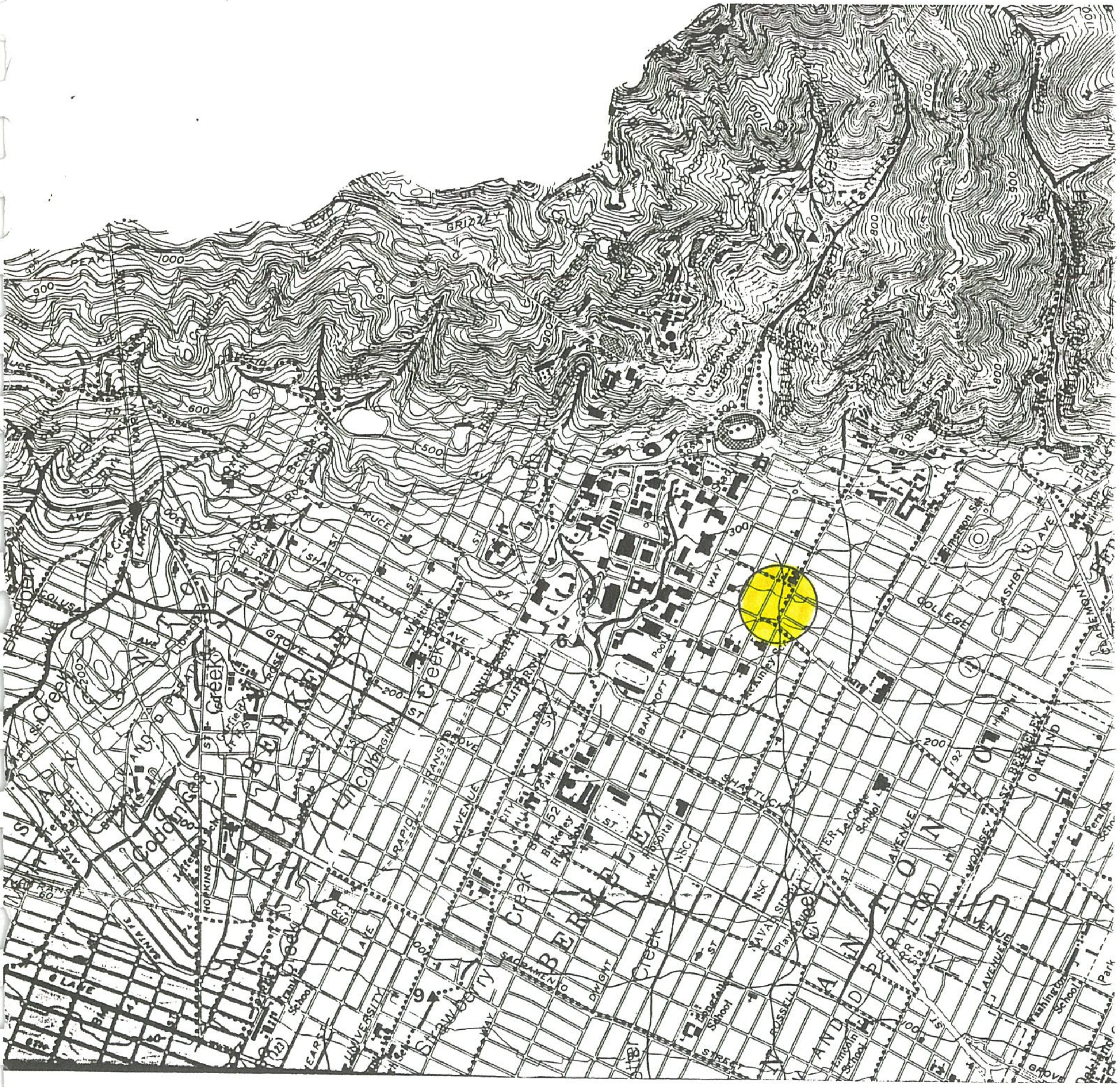
<u>Restoration Channel Shape</u>
Using the large drainage area estimate of .23 square miles, the widest channel restoration project width required from the park space will be 82 feet. This project width assumes a bankfull channel width of 6 feet, a meander amplitude of 16 feet and 60 feet to slope the banks from the floodplain to the park grade. The floodplain width of 22 feet (which includes the width of the bankfull or low flow channel) accommodates a meandering channel with a sinuosity of 1.3. This means the meandering channel length must be 1.3 time the length of the distance between the new up and downstream headwalls to provide for a stable channel without erosion problems.

The design of this project also uses a high (or conservative value) for the Mannings' n - or roughness coefficient. This is done to accommodate the practice in constructing new channels to use soil bio-engineering systems of native plants to secure the stream banks. The plant growth is initially brushy while the pioneer plants become established but in about five years as a canopy of growth from larger shade trees evolves the brushiness and channel roughness decreases.

The restoration dimensions will be adjusted to be somewhat smaller depending on the final selection for the pipe size used to divert the flows from the system B culvert. Therefore, it is expected that the full project right-of-way required will be less than 82 feet.

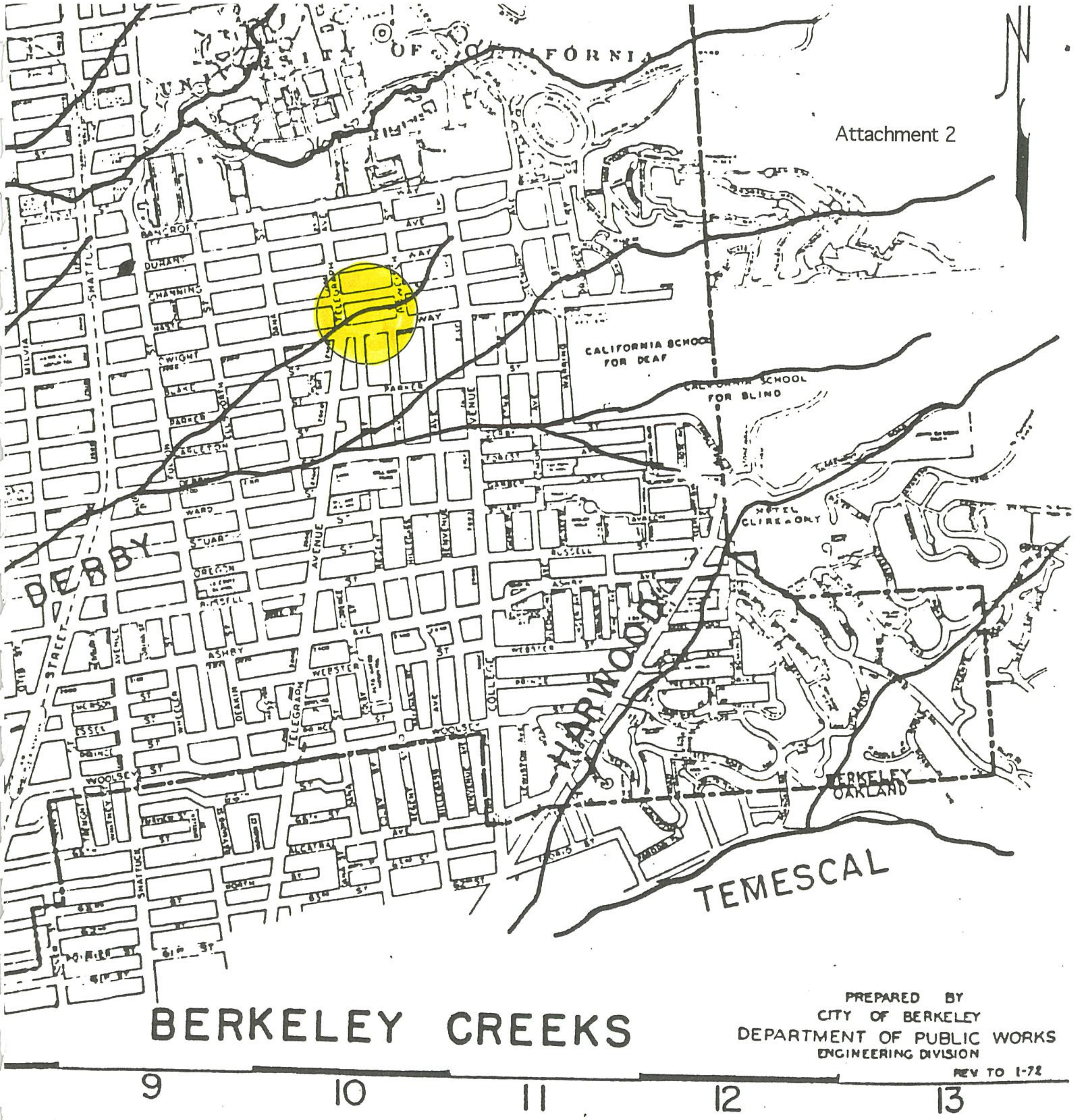
Historical Maps

Attachment 1	Oakland Museum Map
Attachment 2	City of Berkeley Historic Creek Map
Attachment 3	Historic Aerial Photo



Creek and Watershed Map of Oakland and Berkeley
Oakland Museum of California
1993, Revised 1995

Attachment 2



BERKELEY CREEKS

PREPARED BY
CITY OF BERKELEY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
REV TO 1-72

Attachment 3

Pacific Aerial Photo, 4-24-47

Attachments

A. Restoration Channel Dimensions

B. Flood Frequency Curve

C. Regional Values for Bankfull Channel Dimensions

D. Estimates of Frequency and Magnitude of Channel Discharges

E. Open Channel Flows in Restored Channel Assuming Insignificant Backwater from Downstream Culvert

F. Mannings' Calculations

G. Sewer Maps

H. Restoration Design Cross-section

I. Restoration Design Meander Belt

J. Culvert Hydraulics

Attachment A

Restoration Channel Dimensions

Drainage Area:	Sewer System A	= .08 sq. mi.
	Sewer System B	= .14 sq. mi.
	Total Area	= .23 sq. mi. (includes Peoples Park)
Slope:	Surface Slope:	.04

Pipe Size and Depth at Flow Diversion

System A 39" RCP , Depth Between 13' 8" and 12' 9" (Reinforced Concrete Pipe)
System B 20" by 30" RCP, Depth 9' 10"

Pipe Slope: .03 - .04

San Francisco Bay Area Regional Channel Geometry (Leopold-Dunne)
* Adjusted for Local East Bay Region.

System A, Bowditch St. System

Drainage Area: .08 sq. mi.

System B, Dwight Way System

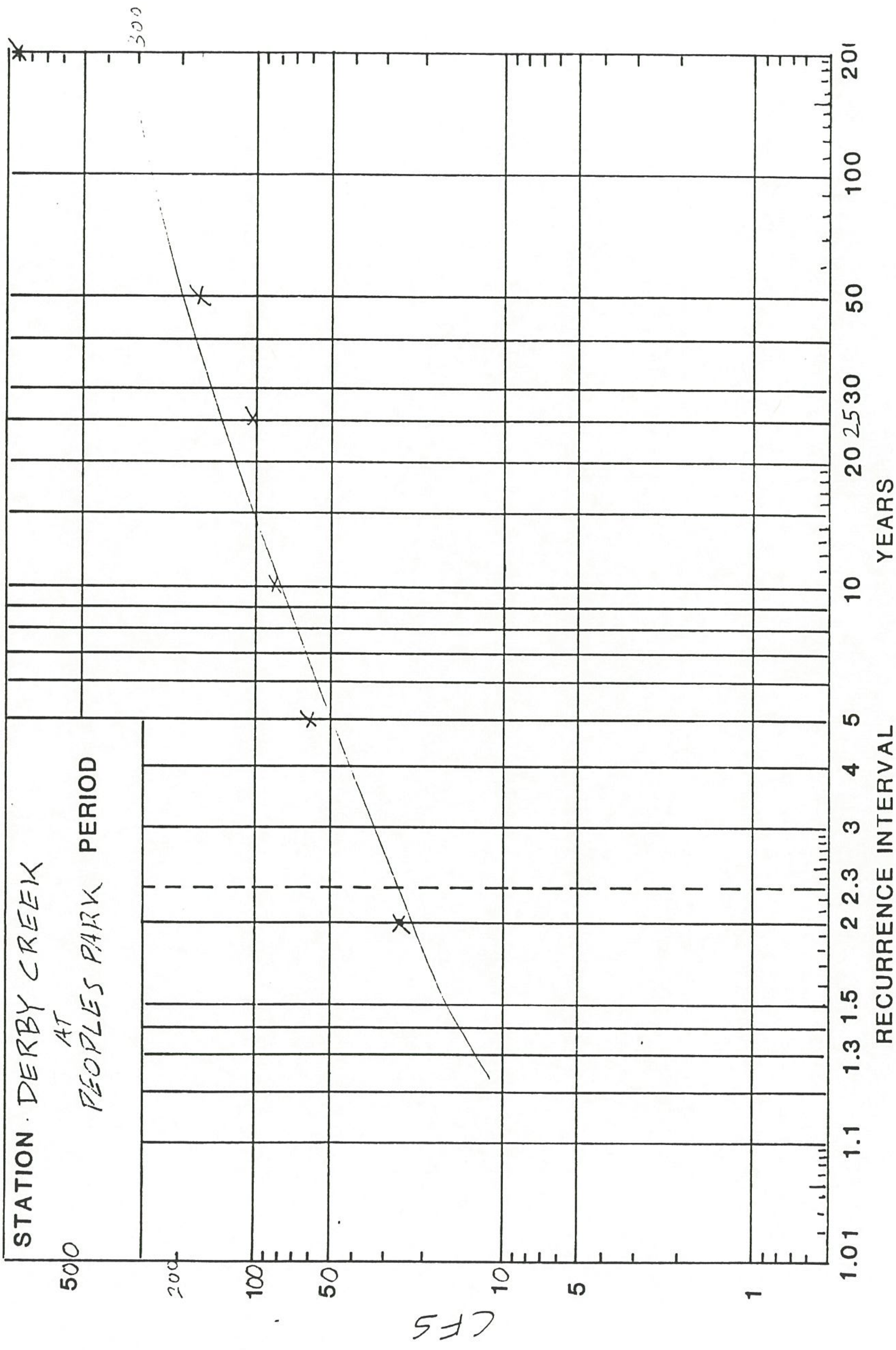
Drainage Area: .14 sq. mi.

System Total

Drainage Area:	.23 sq. mi.
Bankfull Width:	6 ft
Bankfull Depth:	1 ft.
Cross-sectional Area of Bankfull Channel	6 sq. ft.
Meander Length:	66 ft.
Meander Amplitude:	16 ft.
Radius of Curvature	14 ft.
Design Floodplain:	22 ft.
Bankfull Channel Width:	6 ft.
+ Meander Amplitude:	16 ft.

Channel Sinuosity

Meander Length:	66'
Meander Amplitude:	16.2
Radius of Curvature:	13.8
Sinuosity Ratio:	1.3


STATION · DERBY CREEK
AT
PEOPLES PARK
PERIOD
RECURRENCE INTERVAL
YEARS
1.01
1.1
1.3
1.5
2
2.3
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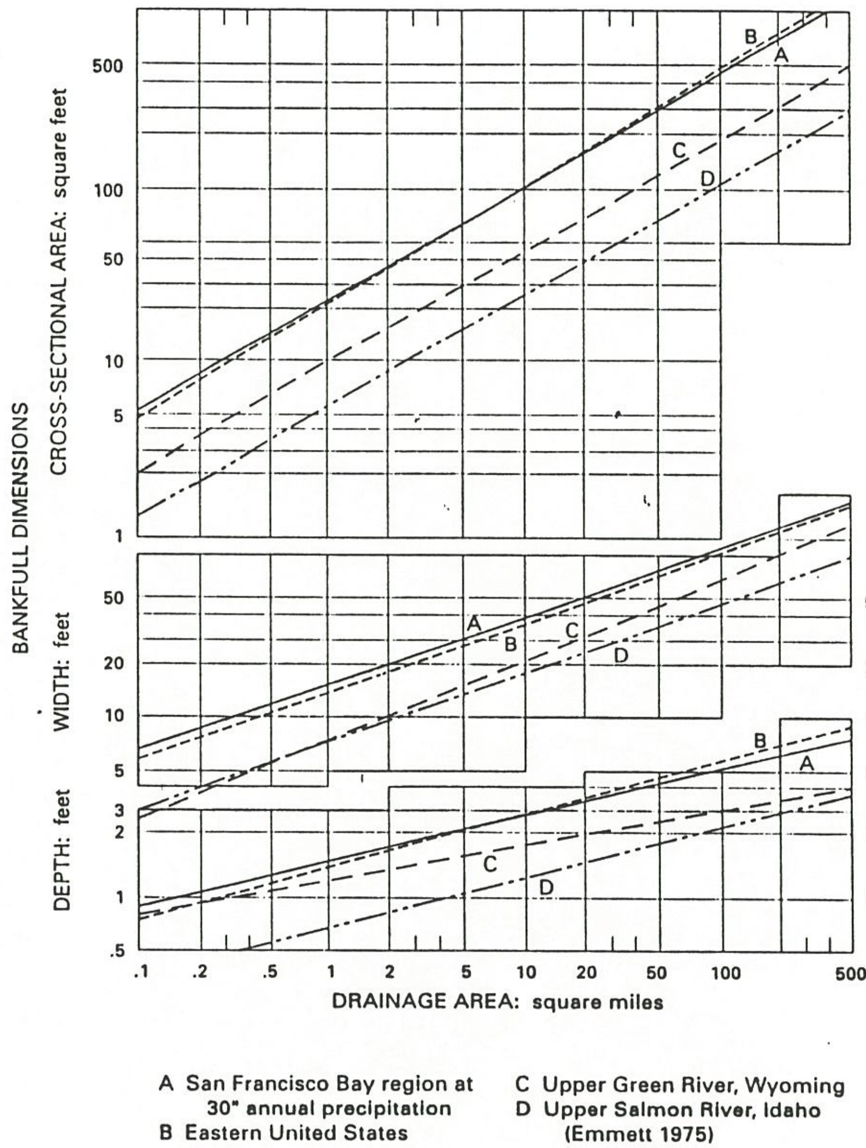


Figure 8.5 Average values of bankfull channel dimensions as a function of drainage area for four regions. (After Dunne and Leopold 1978.)

Attachment D

Estimates of Frequency and Magnitude of Channel Discharges

Average Rainfall: 30"

Drainage Area: .23 sq. mi.

Estimates of Discharges for Different Frequency Storms
(Rantz Multiple Regression Equations for S. F. Bay Area)

Q 2 = .069 (A power.913) (P power 1.965) x unbraided condition ratio

(.26) (798.9)

.069 x 20.73 = 14.33 x 2 = 28 cfs

Q 5 = 2.00 (A power .925) (P power .1.206)

(.25) (60.45)

2.00 x 15.1 = 30.2 x 1.75 = 52.89 cfs

Q 10 = 7.38 (A power .922) (P power .928)

(.257) (23.48)

7.38 x 6.03 = 44.54 x 1.75 = 77.9 cfs

Q 25 = 16.5 (A power .912) (P power .797)

(.261) (15)

16.5 x 3.92 = 64.78 = 103 cfs

Q 50 = 69.6 (A power .847) (P power .511)

(.287) (5.68)

69.6 x 1.63 = 113.5 x 1.6 = 181 cfs

Estimated Bankfull Discharge, San Francisco Bay Regional Relationships,	1.5 Year Q:	12 cfs
Summary of Rantz Multiple Regression Equations:		
	2 Year Q	28 cfs
	5 Year Q.	53 cfs
	10 Year Q.	78 cfs
	25 Year Q.	103 cfs
	50 Year Q.	181 cfs
Flood Frequency Curve Estimate	100 Year Q.	300 cfs

Attachment D
Continued

Estimates of one in 100 Q using Rational Formula:

Assumptions:

Drainage Area:	.23 square miles = 147.2 acres
Urbanization:	99% Sewered
Rainfall Intensity:	2.0 to 2.5 inches per hour

Discharge = Q
Rainfall Intensity = i
Area = Acres

Q = CiA
Q = .95 x 2.25 inches/hr. x 147.2 acres
Q = 314.6 cfs

A close correlation between Rantz and Rational Method Derived 100 Q:
300 cfs and 314 cfs

Attachment E

Summary

Open Channel Flow in Restored Channel without significant Backwater from Culvert

Bankfull Discharge, 1.5 Year Recurrence Interval: 25 cfs, Stage 1 Foot Deep in Bankfull Channel

One in 50 Year Stage at: 117 cfs
1.8 Feet Depth at Bankfull Channel

One in 100 Year Stage at : 300 cfs
2.5 Feet Depth at bfc 286 cfs

Mid-Bank Stage
4 Feet Depth at bfc: 925 CFS (Approximate 1 in 400 Year Recurrence Interval)
Velocity: 9.3 ft./sec.

Mannings' Equation

$$Q. = \frac{1.49}{n} AR\ 2/3\ S\ 1/2$$

Mannings' Equation Calculations for Channel Flow and Depth

$$V = \frac{1.49\ R\ 2/3\ S\ 1/2}{n}$$

Assumptions:

Roughness Coefficient:	.06		
Slope:	.04		
Cross Section Conditions:	Bankfull Channel Width:	6'	
	Bankfull Channel Depth:	1'	
	Floodplain Width:	16'	
	Bank Slopes:	3.1	

Mannings' Equations Continued

Calculations

Estimate channel discharges and stages for restoration channel without backwater

Estimated One in 50 Year Channel Stage
Calculations

1.0 (Bankfull Depth) x 1.8 feet approximate Depth of one in 50 Year R. I.

n = .06 (Roughness)
R = 28 (Hydraulic Radius)
S = .04 (Slope)

V = 1.49 R 2/3 power x S 1/;2 power / n

V = 1.49 (.9 power 2/3) (.04 power 1/2) / .06

V = 4.63 ft./sec.

Q = Area x Velocity   25 x 4.63 = 117 cfs

Area of Channel Inundated = 25.2 sq. ft. (Width x Depth)

Calculated One in 50 Q = 117

Estimated One in 100 Year Channel Stage
Calculations

S = .04 (Slope)
A = 45 Area of Inundation)
R = 31 (Hydraulic Radius)
n = .06 (Roughness)

V = 1.49 (1.45 power 2/3) (.04 power 1/2) / .06

V = 6.35 ft./sec.

Q = Area x Velocity
6.35 x 45 = 286 cfs

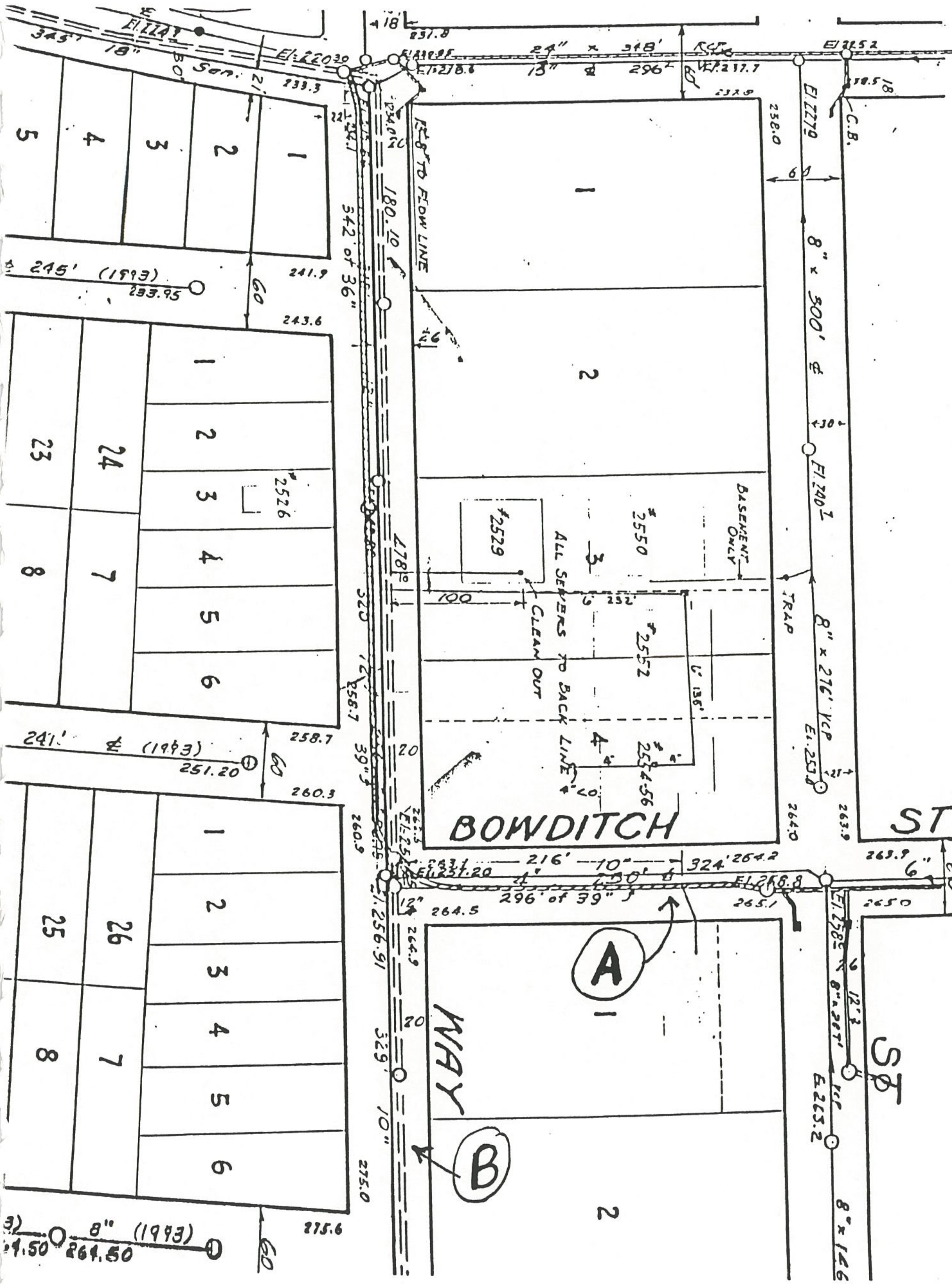
Calculated One in 100 Q = 286

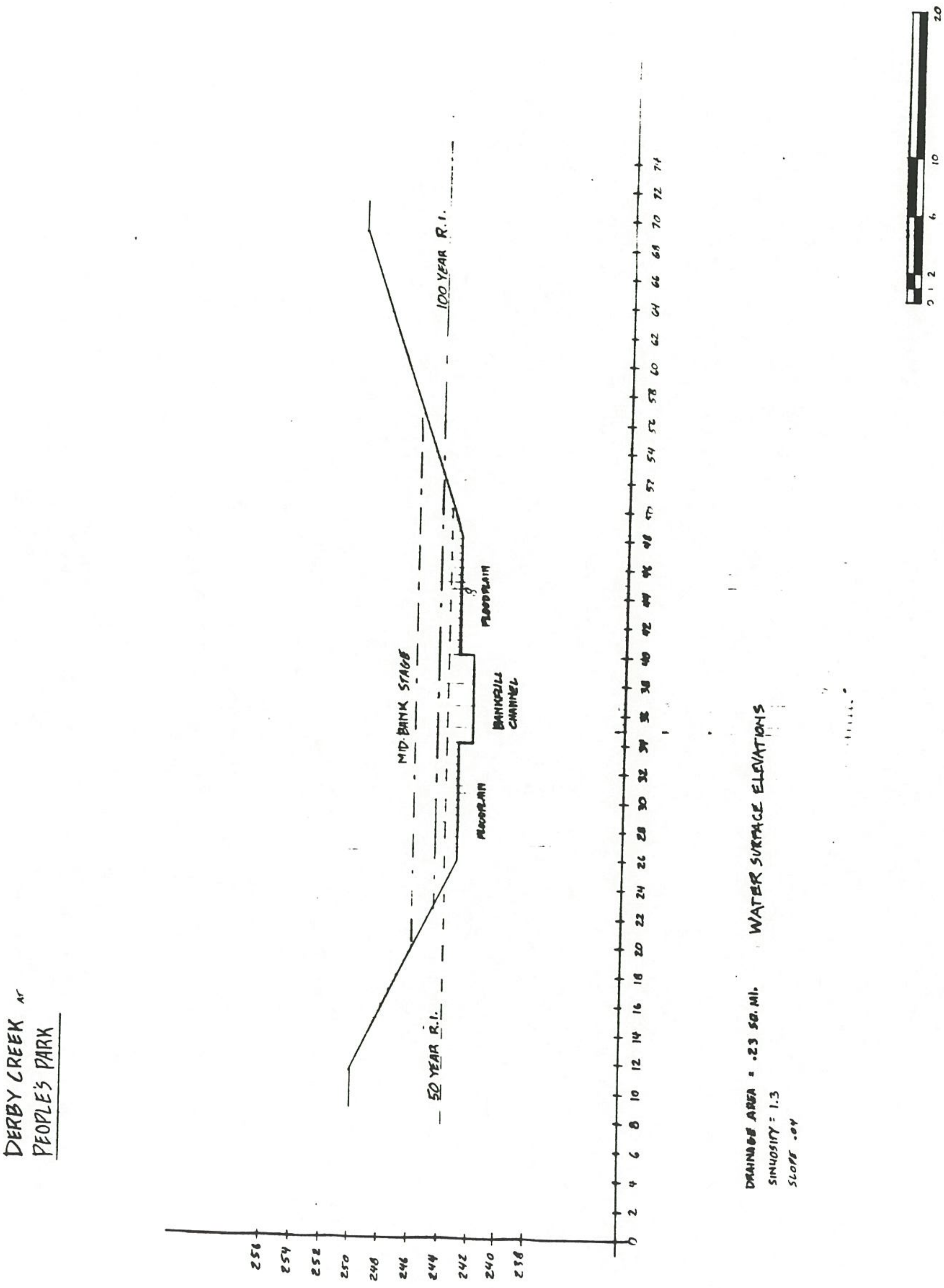
Area of Channel Inundated = 45 sq. ft. (Width x Depth 2.5 sq. ft.)

Estimated One in 400 Year Channel Stage Calculations

V = 1.49 R 2/3 power x S 1/2 power / n

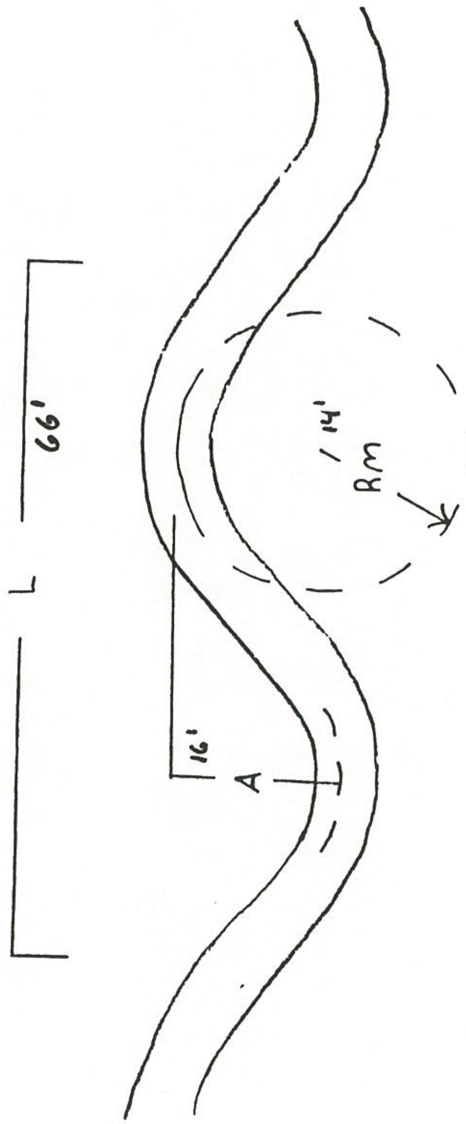
Attachment G





DERBY CREEK AT
PEOPLE'S PARK
100 YEAR R.I.
50 YEAR R.I.
MID-BANK STAGE
FLOODPLAIN
BANKFULL CHANNEL
FLOODPLAIN
WATER SURFACE ELEVATIONS
DRAINAGE AREA = .23 SQ.MI.
SINUOSITY = 1.3
SLOPE .04

Attachment I



Culvert Hydraulics

1) Pipe Friction Factors

Where: F = Friction Factor
L = Length in Feet
R = Hydraulic Radius
V = Velocity
q = Discharge in cubic feet/second
HL = Head Loss

f = hL
(L/D) v2 power/2q

HL = F x L x v2 power / D 2q = F L / 4R x V2 power / 2q

20 ft. per second — v2 / 2q — (20)2 power / 2(32.2) = 6.2'

10 ft. per second — v2 / 2q — (10)2 power / 2(32.2) = 1.55'

2) Elevations:

Derby at Telegraph	238 Feet
Pipe outlet at Bay	0 Feet
	238 Feet of Fall

3) Head Loss

20 ft. per second — HL = HL / 4R x v2 / 2g = 70.27(6.2')

= 436 feet + minor head losses

10 ft. per second — HL = fl / 4R x v2 / 2q = 70.27 (1.55')

= 109 ft. + minor head losses

Approximate Head Available 238 feet,

Therefore the project using full flows from the pipe seems feasible because the velocities are probably between 10 - 20 ft. per second.

Additional Information Needed:

*Field measurements of hydraulic grade line at high flows.

*Flow measurements at several points in the conduit.

Continued

*Maintenance log for the City of Berkeley storm management systems for indications of or how often the culvert surcharges.

Slope of surface immediately below Derby and Telegraph Ave.

$$\frac{60 \text{ foot Drop}}{2000 \text{ feet}} = \text{Slope } .03$$

Head loss in pipe immediately below Derby and Telegraph Ave.

$$HL = F \times \frac{L}{4R} \times \frac{V2 \text{ power}}{2q} = .026 \times \frac{2000}{4(.09)} \times \frac{(20)2 \text{ power}}{\frac{2(322)}{2(32.2)}} = 89.5 \text{ feet}$$

At 20 ft. per second pipe losses probably exceed the elevation loss (in the immediate upstream region)

At 10 ft. per second

$$HL = .026 \times \frac{2000}{4(0.9)} \times \frac{(10)2 \text{ power}}{2(32.2)} = 22.3'$$

Velocity for 60 foot drop

$$60 + \frac{1}{2}\ \frac{n2 \text{ power}}{2Q} + \frac{1}{2}\ \frac{v2}{2Q} = 66 \text{ ft.}$$

Entrance loss + other minor losses = 66 ft.

Velocity = 16 ft. per second
Area = 13.5 sq. ft.
q = 216 cfs

Conclusions From Initial Analysis

Head losses for the culvert removal are at a feasible range for pipe discharges in the range of 200 - 300 cfs. At the high end of discharge estimates for the culvert surcharge the calculations show too high a head loss for a break in the culvert. If the culvert in fact rarely surcharges then we would assume the pipe velocities are in lower ranges than 20 feet per second. Field measurements should be taken to verify a culvert model of the Derby Creek system. If the unlikely event that the upper limit of 300 cfs discharges and 22 feet per second velocities actually occur, the project design should incorporate a T-attachment to the Dwight Way Culvert which provides for continuous low flows to the restoration channel but will convey the large storm flows through the existing storm culvert. If the pipe surcharges at about 200 cfs the system will handle a 60 foot head loss without design modifications.

2/6/19 [illegible] 2/5

Q = 300 cfs

PIPE #	SIZE (LENGTH)	AREA (ft²)	PERIM. (ft)	(1) R = A/P (ft.)	(2) VELOCITY (fps)	(2) $N_R \approx (4R)v$	(3) ε/D = .01'/(4R)	f Fig 8-10	L/(4R)	f·L/4R
1	7' × 9' (1,544')	63. ft²	32.0	1.97	20 fps	157.	.0013	.021	196.	4.12
	6' × 9' (5,777')	54. ft²	30.0	1.80		144.	.0014	.021	802	16.8
	5' × 7½' (540')	37.5 ft²	25.0	1.50		120.	.0017	.023	90.	2.07
	4⅔' × 7' (1625')	32.69 ft²	23.33	1.40		112.	.0018	.023	290.	6.67
	7' ⌀ (2,000')	38.5 ft²	22.0	1.75	APPROXIMATE	140.	.0014	.022	285.	6.27
	4⅓' × 6½' (1,752')	28.16 ft²	21.67	1.30		104.	.0019	.023	337.	7.75
7	4' × 6' (333')	24. ft²	20.0	1.20		96.	.0021	.024	69.	1.66
3	4' × 4½' (310')	18. ft²	17.0	1.06		85.	.0023	.025	73.	1.83
	3' × 4½' (3118')	13.5 ft²	15.0	0.90	$\frac{Q}{A} = \frac{300}{13.5}$ = 22. fps	79.	.0028	.026	886.	23.1
	16,999'									Σ = 70.27

(1) R = HYDRAULIC RADIUS = AREA / WETTED PERIMETER = A/P

(2) N_R = REYNOLDS NUMBER = (4R)·V ; V = VELOCITY

(3) ε/D ≅ .01'/4R (.01' ROUGHNESS FOR OLD CONCRETE PIPE)

Appendix B

California Environmental Quality Act (CEQA):

Appendix E - (Part 1) Initial Study Environmental Information Form.

Culled from the City of San Leandro

April 3, 1989

Application No.________________

APPENDIX E - (PART 1)
INITIAL STUDY
(ENVIRONMENTAL INFORMATION FORM)
(To be prepared pursuant to San Leandro Administrative Code §28.1.135(a))

Date Filed________________

GENERAL INFORMATION

1. Name and address of developer or project sponsor:________________

2. Address of project:________________
   Assessor's Block and Lot Number:________________

3. Name, address and telephone number of person to be contacted concerning this project:________________

4. List and describe any other related permits and other public approvals required for this project, including those required by city, regional, state and federal agencies:________________

5. Existing zoning district:________________

6. Description of Project: (Include site area, uses, size and number of buildings, parking, number of dwelling units, scheduling, and any other information necessary or helpful to understand project. This description must be complete and accurate. Exhibits or photographs should be identified and attached). (Please attach).

7. Are the following items applicable to the project or its effects? Discuss below all items checked (attach additional sheets as necessary).

YES	NO	SOURCE		
___	___	______*	1.	Change in existing features of any bays, tidelands, beaches, lakes or hills, or substantial alteration of ground contours.
___	___	______	2.	Change in scenic views or vistas from existing residential areas or public lands or roads.
___	___	______	3.	Change in pattern, scale or character of general area of project.
___	___	______	4.	Significant amounts of solid waste or litter.

*Refers to appropriate note on page 2.
4/3/89

YES	NO	SOURCE		
___	___	______	5.	Change in dust, ash, smoke, fumes or odors in vicinity.
___	___	______	6.	Change in ocean, bay, lake, stream or ground water quality or quantity, or alteration of existing drainage patterns.
___	___	______	7.	Substantial change in existing noise or vibration levels in the vicinity.
___	___	______	8.	Site on filled land or on slope of 10 percent or more.
___	___	______	9.	Use of disposal of potentially hazardous materials, such as toxic substances, flammables or explosives.
___	___	______	10.	Substantial change in demand for municipal services (police, fire, water, sewage, etc.).
___	___	______	11.	Substantially increase fossil fuel consumption (electricity, oil, natural gas, etc.).
___	___	______	12.	Relationship to a larger project or series of projects.

ENVIRONMENTAL SETTING

8. Briefly describe the project site as it exists before the project, including information on topography, soil stability, plants and animals, and any cultural, historical or scenic aspects. Describe any existing structures on the site, and the use of the structures. If necessary, attach photographs of the site.

____
____
____
____
____
____

9. Briefly describe the surrounding properties, including information on plants and animals, any cultural, historical or scenic aspects and the type of land use.

____
____
____
____
____
____

CERTIFICATION: I hereby certify that the statements furnished above and in the attached exhibits present the data and information required for this initial evaluation to the best of my ability, and that the facts, statements, and information presented are true and correct to the best of my knowledge and belief.

4/3/89
Dated:____________________ ____
(Signature)

____
(Print Name)

____
(Title)

(1) Determination based on location of project.
(2) Determination based on staff office review.
(3) Determination based on field review.
(4) Determination based on information contained in the Plaza II Redevelopment Plan.
(5) Determination based on the San Leandro General Plan.
(6) Determination based on the San Leandro Zoning Code.
(7) Not applicable.
(8) Other (state data).

Application No.____________________ Part 1 Submitted on ______________
(Date)

APPENDIX E - (PART 2)
INITIAL STUDY
(ENVIRONMENTAL CHECKLIST FORM)
(To be filed pursuant to San Leandro Administrative Code §28.1.135(a))

I. BACKGROUND

1. Name, Address and Phone Number of Proponent:______________________________
____

2. Agency Requiring Checklist______________________________

3. Name of Proposal, if applicable______________________________

II. ENVIRONMENTAL IMPACTS
(Explanation of all answers is required. Attach additional sheets if necessary).

	YES	MAYBE	NO	SOURCE
1. EARTH. Will the proposal result in:				
a. Unstable earth conditions or in changes in geologic substructures?	___	___	___	___*
b. Disruptions, displacements, compaction or overcovering of the soil?	___	___	___	___
c. Change in topography or ground surface relief features?	___	___	___	___
d. The destruction, covering or modification of any unique geologic or physical features?	___	___	___	___
e. Any increase in wind or water erosion of soils, either on or off the site?	___	___	___	___
f. Changes in deposition or erosion of beach sands, or changes in siltation, deposition, or erosion which may modify the channel of a river or stream or the bed of the ocean or any bay, inlet or lake?	___	___	___	___
g. Exposure of people or property to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?	___	___	___	___
2. AIR. Will the proposal result in:				
a. Substantial air emissions or deterioration of ambient air quality?	___	___	___	___
b. The creation of objectionable odors?	___	___	___	___
c. Alteration of air movement, moisture or temperature, or any change in climate, either locally or regionally?	___	___	___	___
3. WATER. Will the proposal result in:				
a. Changes in currents, or the course or direction of water movements, in either marine or fresh waters?	___	___	___	___

*Refers to appropriate note on page 4.

	YES	MAYBE	NO	SOURCE
b. Changes in absorption rates, drainage patterns or the rate and amount of surface water runoff?	___	___	___	___
c. Alterations to the course or flow of flood waters?	___	___	___	___
d. Discharge into surface waters, or in any alteration of surface water quality, including but not limited to, temperature, dissolved oxygen or turbidity?	___	___	___	___
e. Alteration of the direction of rate of flow of ground waters?	___	___	___	___
f. Change in the quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations?	___	___	___	___
g. Substantial reduction in the amount of water otherwise available for public water supplies?	___	___	___	___
h. Exposure of people or property to water related hazards such as flooding or tidal waves?	___	___	___	___
4. PLANT LIFE. Will the proposal result in:				
a. Change in the diversity of species, or number of any species of plants (including trees, shrubs, grass, crops, and aquatic plants)?	___	___	___	___
b. Reduction of the numbers of any unique, rare or endangered species of plants?	___	___	___	___
c. Introduction of new species of plants in a barrier to the normal replenishment of existing species?	___	___	___	___
5. ANIMAL LIFE. Will the proposal result in:				
a. Change in the diversity of species, or numbers of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms or insects)?	___	___	___	___
b. Reduction of the numbers of any unique, rare or endangered species of animals?	___	___	___	___
c. Introduction of new species of animals into an area, or result in a barrier to the migration or movement of animals?	___	___	___	___
d. Deterioration to existing fish or wildlife habitat?	___	___	___	___
6. NOISE. Will the proposal result in:				
a. Increases in existing noise levels?	___	___	___	___
b. Exposure of people to severe noise levels?	___	___	___	___
7. LIGHT AND GLARE. Will the proposal produce new light or glare?	___	___	___	___
8. LAND USE. Will the proposal result in a substantial alteration of the present or planned land use or an area?	___	___	___	___

	YES	MAYBE	NO	SOURCE
9. NATURAL RESOURCES. Will the proposal result in?				
a. Increase in the rate of use of any natural resources?				
b. Substantial depletion of any nonrenewable natural resource?				
10. RISK OF UPSET. Will the proposal involve:				
a. A risk of an explosion or the release of hazardous substances (including, but not limited to, oil, pesticides, chemicals or radiation) in the event of an accident or upset conditions?				
b. Possible interference with an emergency response plan or an emergency evacuation plan?				
11. POPULATION. Will the proposal alter the location, distribution, density, or growth rate of the human population of an area?				
12. HOUSING. Will the proposal affect existing housing, or create a demand for additional housing?				
13. TRANSPORTATION/CIRCULATION. Will the proposal result in:				
a. Generation of substantial additional vehicular movement?				
b. Effects on existing parking facilities, or demand for new parking?				
c. Substantial impact upon existing transportation and traffic systems?				
d. Alterations to present patterns of circulation or movement of people and/or goods?				
e. Alterations to waterborne, rail or air traffic?				
f. Increase in traffic hazards to motor vehicles, bicyclists or pedestrians?				
14. PUBLIC SERVICES. Will the proposal have an effect upon, or result in a need for new or altered governmental services in any of the following areas:				
a. Fire protection?				
b. Police protection?				
c. Schools?				
d. Parks or other recreational facilities?				
e. Maintenance of public facilities, including roads?				
f. Other governmental services?				

	YES	MAYBE	NO	SOURCE
15. ENERGY. Will the proposal result in:				
a. Use of substantial amounts of fuel or energy?	___	___	___	___
b. Substantial increase in demand upon existing sources of energy or require the development of new sources of energy?	___	___	___	___
16. UTILITIES. Will the proposal result in a need for new systems or substantial alterations to the following utilities:				
a. Power or natural gas?	___	___	___	___
b. Communications systems?	___	___	___	___
c. Water?	___	___	___	___
d. Sewer or septic tanks?	___	___	___	___
e. Storm water drainage?	___	___	___	___
f. Solid waste and disposal?	___	___	___	___
17. HUMAN HEALTH. Will the proposal result in:				
a. Creation of any health hazard or potential health hazard (excluding mental health)?	___	___	___	___
b. Exposure of people to potential health hazards?	___	___	___	___
18. **AESTHETICS.** Will the proposal result in the obstruction of any scenic vista or view open to the public, or will the proposal result in the creation of an aesthetically offensive site open to public view?	___	___	___	___
19. **RECREATION.** Will the proposal result in an impact upon the quality or quantity of existing recreational opportunities?	___	___	___	___
20. CULTURAL RESOURCES.				
a. Will the proposal result in the alteration of or the destruction of a prehistoric or historic archeological site?	___	___	___	___
b. Will the proposal result in adverse physical or aesthetic effects to a prehistoric, historic, or architecturally significant building, structure, or object?	___	___	___	___
c. Does the proposal have the potential to cause a physical change which would affect unique ethnic cultural values?	___	___	___	___
21. MANDATORY FINDINGS OF SIGNIFICANCE.				
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community,				

	YES	MAYBE	NO	SOURCE
reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	___	___	___	___
b. Does the project have the potential to achieve short-term to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time while long-term impacts will endure well into the future).	___	___	___	___
c. Does the project have impacts which are individually limited but cumulatively considerable? (A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant).	___	___	___	___
d. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	___	___	___	___

III. DISCUSSION OF ENVIRONMENTAL EVALUATION (Attach Statement)

IV. DETERMINATION (To be completed by the lead agency)

On the basis of this initial evaluation:

_____ I find the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION WILL BE PREPARED.

_____ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because the mitigation measures described on an attached sheet have been added to the project. A NEGATIVE DECLARATION WILL BE PREPARED.

_____ I find the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

______________________________ ______________________________
(Signature) (Title)

______________________________ ______________________________
(Printed Name) (Date)

(1) Determination based on location of project.
(2) Determination based on staff office review.
(3) Determination based on field review.
(4) Determination based on information contained in the Plaza II Redevelopment Plan.
(5) Determination based on the San Leandro General Plan.
(6) Determination based on the San Leandro Zoning Code.
(7) Not applicable.
(8) Other (state data).

Appendix C

Detailed Cost Estimate

Landscape Architect's Opinion on Probable Construction Costs

Prepared by Wolfe Mason Associates, Inc.

April 16, 1998

APPENDIX C: LANDSCAPE ARCHITECT'S OPINION ON PROBABLE CONSTRUCTION COSTS						
Derby Creek at People's Park, Berkeley, California						
Item	**Description**	**Quantity**	**Unit**	**Cost**	**Price**	**Total**
0.0	**PROJECT START-UP**					**$14,000**
0.1	Permits (Fees & Processing):		Allow	$3,500	$3,500	
	• Fish & Game		Each		$0	
	• Regional Water Quality Control Board		Each		$0	
	• Army Corps		Each		$0	
0.2	Dewatering: Coffer Dam, Pipe, etc. (NOT NEEDED)		Allow		$0	
0.3	Temp. Fencing inc.Sediment Barriers & Silt Fences		Allow	$2,500	$2,500	
0.4	Tree Protection		Allow	$1,000	$1,000	
0.5	Traffic Control		Allow	$2,000	$2,000	
0.6	Survey Control & Staking		Allow	$5,000	$5,000	
1.0	**DEMOLITION**					**$22,800**
1.1	Realign (ex) elect. line & box being used for park lights		Allow	$10,000	$10,000	
1.2	(All other utilities appear to be outside the const. zone)					
1.3	Tree Removal & Pruning	12	Each	$150	$1,800	
1.4	Demolition: Site clearing; disposal off-site	40,000	SF	$0.20	$8,000	
1.5	Demolition: Misc. items; disposal off-site		Allow	$1,500	$1,500	
1.6	Sawcut @ culverts	3	Each	$500	$1,500	
2.0	**GRADING**					**$52,500**
2.1	Soil excavation @ daylight sections	5,000	CY	$5	$25,000	
2.2	Stockpile cut soil on-site	0	CY	$2	$0	
2.3	Off haul cut soil inc. loader, operator & trucking	5,000	CY	$4	$17,500	
2.4	Rough grading	40,000	SF	$0.25	$10,000	
3.0	**NEW WALLS, PAVING and DRAINAGE STRUCTURES**					**$91,250**
	Manhole/Junction Box w/ 'T' Bypass @ upstream end	1	Each	$5,000	$5,000	
	Manhole/Junction Box @ downstream end	1	Each	$3,500	$3,500	
	36" RCP in Park (Soil)	70	LF	$100	$7,000	
	36" RCP under sidewalk & street	50	LF	$150	$7,500	
	Stone ret. walls @ 2 Entries - 130 LF @ 8 ft. high	1,040	FF	$50	$52,000	
	Stone ret. walls @ Pine Tree - 45 LF @ 5 ft. high	225	FF	$50	$11,250	
	Misc. pavement repair inc. sidewalks		Allow	$5,000	$5,000	
4.0	**CREEK FINISH GRADING and SLOPE STABILIZATION**					**$42,920**
	Coordination between rough grading & creek layout		Allow	$500	$500	
	Finish grade low and bankful channels	410	LF	$5.00	$2,050	
	Build pool and riffle runs		Allow	$5,000	$5,000	
	Import boulders for stabilization and pools		Allow	$5,000	$5,000	
	Import stone & gravel for creek bed		Allow	$1,500	$1,500	
	Anchor toe @ both sides (coir & large brush bundles)	820	LF	$3.50	$2,870	
	Finish grade banks & stabilize with wattles.	20,000	SF	$0.50	$10,000	
	Erosion control fabric & pole cuttings @ banks	20,000	SF	$0.50	$10,000	
	Monitoring and maintenance	6	Month	$1,000	$6,000	
5.0	**RIPARIAN ZONE PLANTING**					**$42,300**
	Trees (15 gal)	20	Each	$125	$2,500	
	Shrubs/Ground Cover (5 Gal)	450	Each	$35	$15,750	
	Shrubs/Ground Cover (1 Gal)	1000	Each	$10	$10,000	
	Ground Cover (Flats)	20,000	S.F.	$0.30	$6,000	
	Mulch, 20,000 @ 3" depth	185	C.Y.	$30	$5,550	
	Re-seed turf edge	5,000	S.F.	$0.30	$1,500	
	Monitoring and Maintenance	3	Month	$1,000	$1,000	

LANDSCAPE ARCHITECT'S OPINION ON PROBABLE CONSTRUCTION COSTS						
Item	**Description**	**Quantity**	**Unit**	**Cost**	**Price**	**Total**
6.0	**IRRIGATION for BANK STABILIZATION & RIPARIAN PLANTINGS**					**$35,250**
	Auto irrigation system: north bank	16,000	S.F.	$1.25	$20,000	
	Auto irrigation system: south bank	11,000	S.F.	$1.25	$13,750	
	New Controller (Service using ex. meter)	1	Each	$1,500	$1,500	
7.0	**PATHS, BRIDGES and OVERLOOKS**					**$94,000**
	Path, D. G. @ creekside shoulder; 4' wide w/headers	150	LF	$8.00	$1,200	
	Concrete path/pad in flood plain	200	SF	$4.00	$800	
	Entry plaza & overlook @ west end of creek		Allow	$25,000	$25,000	
	Entry plaza & overlook @ east end of creek		Allow	$15,000	$15,000	
	Additional small overlooks	3	Each	$2,000	$6,000	
	Pedestrian Bridge, 70 ft. & headwalls	1	Each	$40,000	$40,000	
	Railing overlook along Dwight Way	300	LF	$20.00	$6,000	
8.0	**SITE AMENITIES (To be determined)**					**$0**
	Site Furniture: Benches, Tables, Receptacles		Allow		$0	
	Pathway Lighting		Allow		$0	
	Trail signage		Allow		$0	
	Educational Signage		Allow		$0	
SUBTOTAL ESTIMATED CONSTRUCTION BASICS					Minimum	**$395,020**
	Contingency 10%					$39,502
TOTAL ESTIMATED CONSTRUCTION BASICS					Minimum	**$434,522**
	Design & Engineering 15%					$65,178
TOTAL ESTIMATED PROJECT					Minimum	**$499,700**

Appendix D

Precedents and Examples

Blackberry Creek, Thousand Oaks School Berkeley, CA

■ BLACKBERRY CREEK
1991-1996

The need to structurally upgrade Thousand Oaks School in the event of a major earthquake provided a unique opportunity to correct an environmental wrong by restoring the portion of Blackberry Creek that runs through the schoolyard. The Berkeley Unified School District and Thousand Oaks School PTA were jointly awarded a $144,000 grant from the State of California Department of Water Resources.

The daylighting and restoration of the original creek benefits school children, neighborhood residents and Solano Avenue businesses. It restores a portion of the area's original natural habitat while improving existing drainage and flooding problems on the school site. The restoration facilitates innovative ongoing educational programs centered on the creek.

Wolfe Mason Associates provided the planning, design and facilitation of Blackberry Creek together with active participation from the Urban Creeks Council, Thousand Oaks PTA, School Architect, City Landscape Architect, community and flexible contractor.

DATA

Site: *A .60 acre creek and park adjacent to Thousand Oaks Elementary School, Berkeley, CA*

Program: *To uncover and restore the buried Blackberry Creek for public use and provide an educational resource for the adjoining grade school.*

Client: *Berkeley Unified School District*
Lew Jones (510) 644-4594
Urban Creeks Council
(510) 540-6669

Award: *Outstanding Landscape Design: The Berkeley Architectural Heritage Association, 1995.*

Before

After

Blackberry Creek
Berkeley, CA