

FINAL DRAFT



ORRS CREEK HABITAT ENHANCEMENT AND FLOOD CONTROL STUDY

Submitted to the:
CITY OF UKIAH

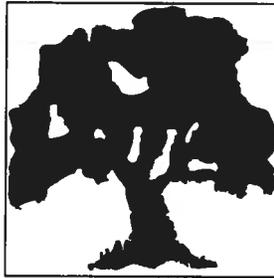
Prepared by:
BRADY/LSA

SUMMER 1999

B R A D Y

LSA

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**Ukiah Orrs Creek Habitat Enhancement and
Flood Control Study**

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UKIAH ORRS CREEK HABITAT ENHANCEMENT AND FLOOD CONTROL STUDY

■ ■ ■

A. History and Overview

Orrs Creek is the largest creek running through the city of Ukiah (the City) to the Russian River. It has historically been an important waterway for the City. Once it was a healthy and complex tributary to the Russian River, supporting a wide variety of wildlife, as well as a strong anadromous salmonid population. As it passes through the City, Orrs Creek no longer supports the diversity of wildlife and native fish populations that it once did. However, the California Department of Fish and Game (CDFG) believes it may be possible to rehabilitate the Creek so that it can once again provide spawning grounds for salmon and other native fish species.

Over the years there have been many interventions in the urban section of Orrs Creek. The Bush Street-State Street reach of Orrs Creek has been bridged, channeled and re-routed over the past 50 years, causing some entrenchment of the Creek. The seasonal creation of a large gravel deposition immediately downstream of the Oak Street bridge has been a City concern for flood control and protection of the bridge structure.

1. 1967 Creek Straightening

Specific impacts include the 1967 "straightening" of the Creek from Bush to Oak Streets, cutting off a prominent meander (Figure 1). The removal of the meander significantly decreased the width of the channel and the channel slope, and increased the depth and flow velocity of the Creek. These changes in the Creek geometry, along with the placement of bridge culverts which do not align with the direction of the stream channel flow (thalweg), have led to the regular deposition of gravels (i.e., particles .08 to 2.5 inches) and other larger particles below the Oak Street bridge. The area varies yearly, but is roughly 50 ft. x 150 ft. in length. Gravel bars often reach a height of 2- to 3 ft.

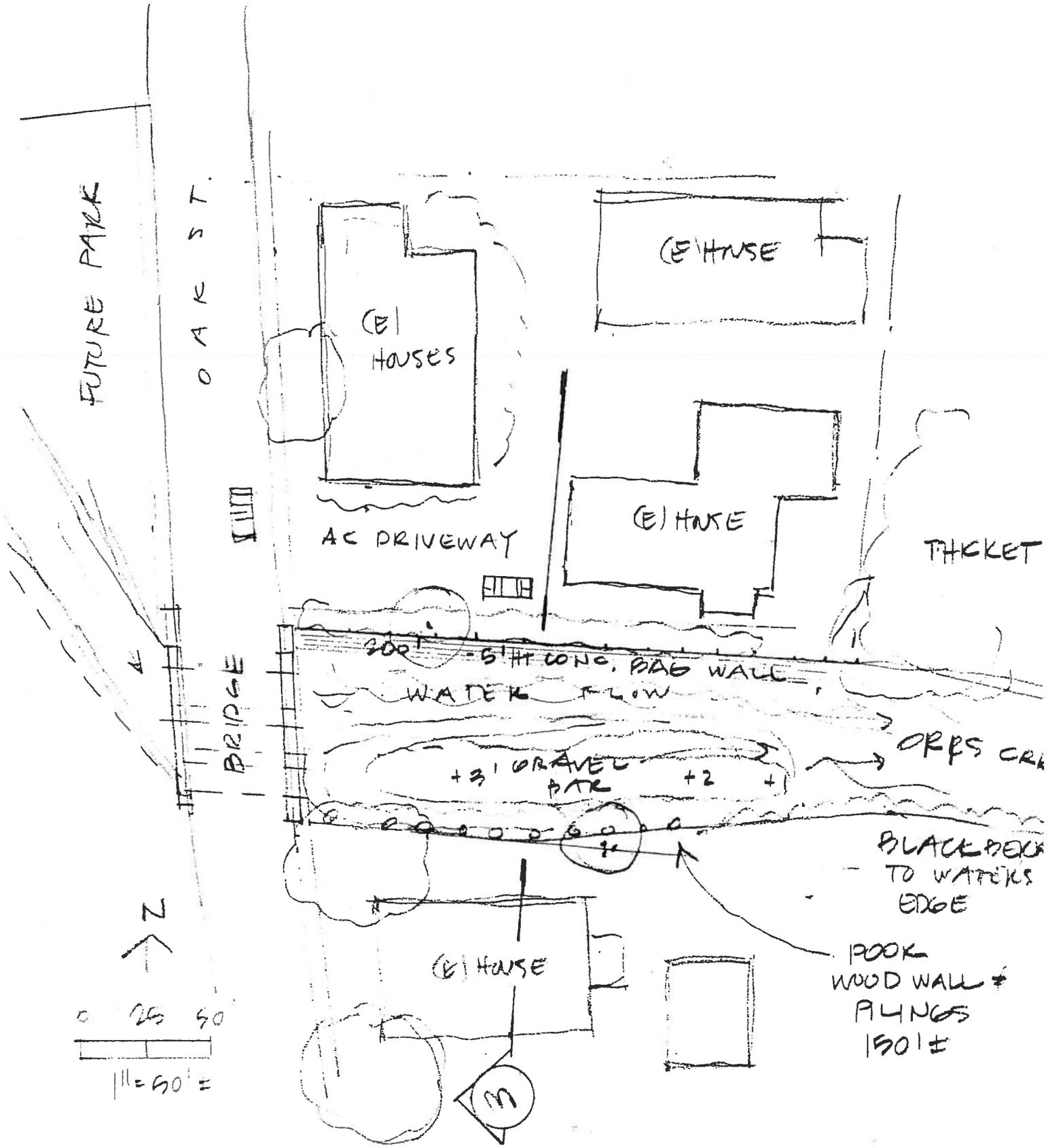


1967 CHANGE @ BUSH/OAK
 PLAN - ALIGNMENTS

UKIAH ORRS CREEK
 BRADY, LSA

1

2 JULY 99



CREEK RESTORATION BELOW OAK ST BRIDGE

SCHMATIC PLAN - EXISTING

UKIAH ORRS CREEK HABITAT / FLOOD
BRADY USA

JULY 99

2

2. Gravel Removal

Annually since the 1967, the City Department of Public Works has removed gravel from below the Oak Street bridge during the dry season as a flood control measure and to prevent damage to the metal bridge culverts from gravel abrasion (See Figure 2). It is not known whether this gravel removal is necessary to prevent flooding as the gravel has never been left in place through the next wet season.

The combination of gravel accretion and later removal of gravel below the Oak Street bridge has exacerbated bank erosion and may have caused other problems. Gravel deposition at this point has contributed to erosion farther downstream in areas that would otherwise have been protected from erosion by deposits of gravel and other larger particles in the streambed. Habitat for fish species has been degraded due to the lack of gravel in the downstream areas.

3. Oak Street Bridge Culverts

The original design of the Oak Street bridge has contributed to the gravel accretion problems. The three ½ arch shaped pipe culverts of the bridge divide the water flow, encouraging the channel to split, which slows the flow of the Creek at this point (See Figure 3). In winter, logs and other storm debris catch on the culverts, further slowing the Creek and adding to gravel deposition. City crews must remove this debris several times each winter season to prevent overtopping during floods. The solid concrete handrails of the roadway are another design problem of the bridge. Flood waters can not flow through the bridge at the road level but are held back by these closed railings. In the event of a flood this antiquated design could actually cause an increase in flooding.

The owner of the property located above the downstream south bank of the channel off Oak Street is concerned that the gravel removal may have caused damage to a wooden cribwall on his property. The City has been reviewing wall replacement options with this property owner. The opposite property on the north bank has a stacked concrete bag wall that leans away from the waters edge. This wall has an unnatural appearance with its uniform height and level top. A more natural looking wall that would allow some riparian vegetation and a softening of the bank edge would give a better long-term appearance.

WINTER STORM DAMAGES
REMOVED DURING STORMS
BY CITY CREWS

OAK ST BRIDGE
CONC SOLID RAIL

CONC. BRIDGE

70'-80' PLAIN

OKRS CREEK
GRAVEL DEPOSIT

TIMBER
WALL

20'-25'

SOUTH SIDE
HOUSE

5

HOUSE
BEYOND
@ OAK.

DRIVEWAY
BEYOND

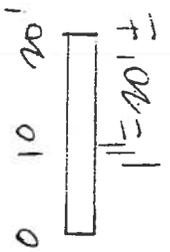
NORTHSIDE
HOUSE

30'

CONC SACK
WALL

20'-25'

WATER



BELOW OAK ST. BRIDGE

SECTION - EXISTING

UKIAH OKRS CREEK
BRADY USA

5

JULY 99

B. Project Background

In the past few years, problems along Orrs Creek have received much attention. In addition to the concerns of the owner of the property with the deteriorated cribwall, there were three events relating to the Creek that triggered action by the City:

1. A preliminary work plan for Orr Creek restoration by Bill Randolph of Alta California Associates;
2. A letter from Mendocino County Fish and Game Commissioner Rudolph H. Light, which supported Randolph's proposal and highlighted Light's concerns about the gravel removal at the Creek; and
3. A stream inventory and draft report by the California Department of Fish and Game (CDFG).

Each is discussed in more detail below.

1. Alta California Associates

Bill Randolph of Alta California Associates in 1997 developed his "Orrs Creek Restoration: A Preliminary Work Plan" after walking the Creek with a representative of the CDFG. Using the information gathered on this walk, Randolph wrote a proposal for the restoration of approximately 1.2 miles of Orrs Creek. The proposal recommends riparian plantings and structural implants to stabilize the banks of the Creek as well as specific suggestions for improving pools, blocking bicycle traffic from the Creek, and providing better public access to the Creek. In May 1999, with the approval of the City and Commissioner Light, Randolph applied to the California Department of Water Resources for an Urban Stream Restoration Grant to enable Alta California Associates to carry out the work outlined in the proposal.

2. Comments by Mendocino Fish and Game Commissioner Light

The next event that prompted this study was a letter dated May 28, 1998, from commissioner Light responding to the proposal by Randolph and identifying the commissioner's concerns with the annual removal of gravel from Orrs Creek. The commissioner supported Randolph's proposal but pointed out that unless the gravel removal ceased, any restoration would be next to useless. He noted problems caused by the gravel removal including the increase in both the depth of the channel and the steepness of the bank slopes downstream, and the potential negative impact on steelhead trout and coho salmon from the lack of gravel in the streambed below the removal area at Oak Street.

Commissioner Light noted that since gravel had never been allowed to accumulate and remain over the subsequent winter season, there was no evidence that flooding would occur if the gravel was to remain in place. He concluded that if left to itself, the gravel might be carried downstream by the Creek. A possible problem with this policy change was noted.

Light had several ideas for the restoration of the Creek. He suggested either leaving the gravel below Oak Street or transporting it to a location lower down the Creek. To repair the current creek bottom damage to the stream, he suggested building small wooden check dams with central notches, fortified with rock on the downstream side. These dams should be low enough for fish to swim past.

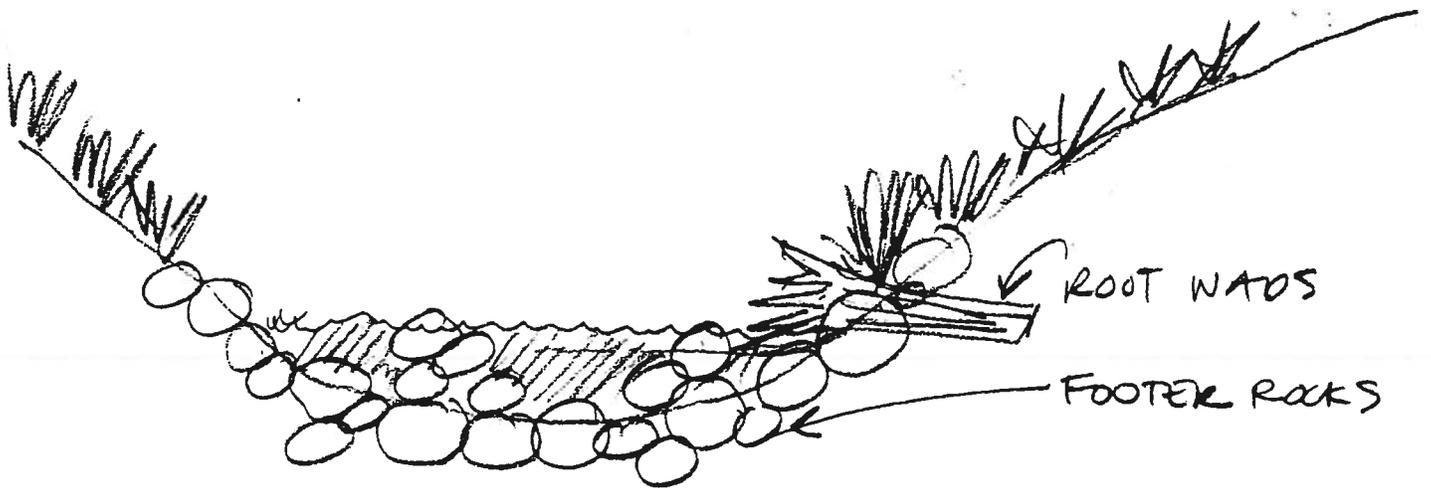
Commissioner Light also endorsed a long term City stream management and restoration plan. He pointed out several areas where such a program had been successful, including both String Creek and Streeter Creek in Mendocino County.

3. California Department of Fish and Game Draft Orrs Creek Inventory

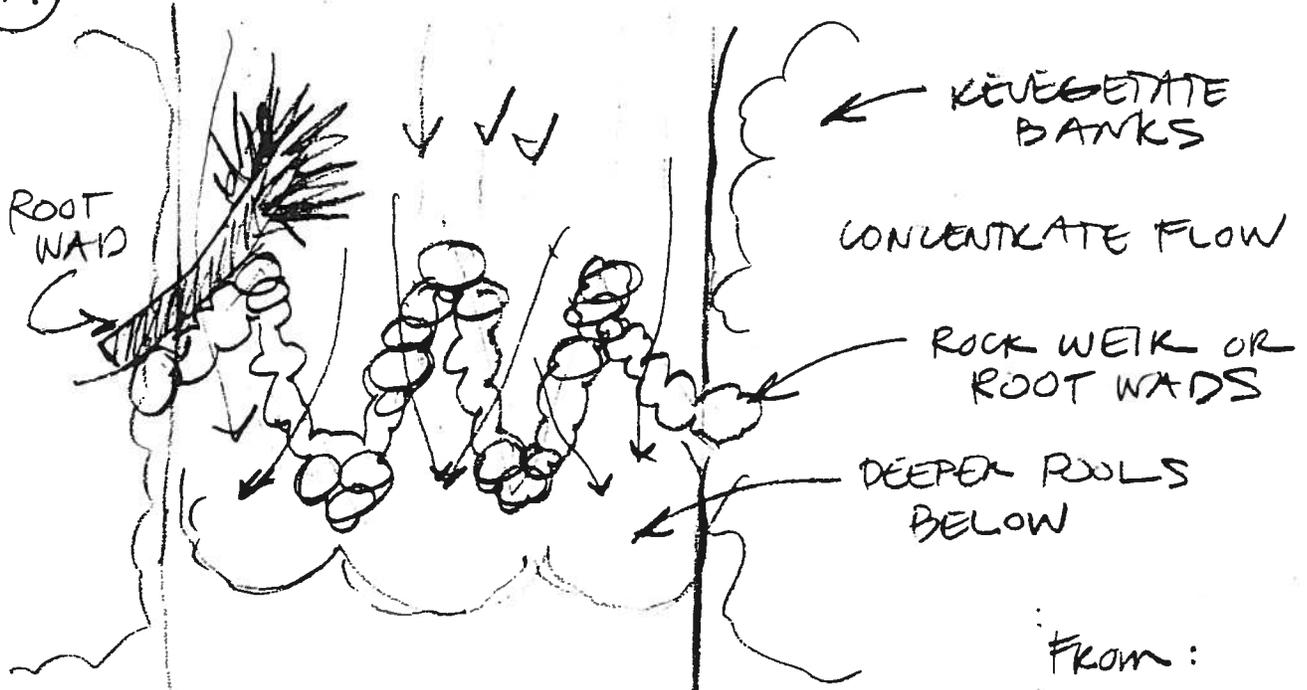
The California Department of Fish and Game did an inventory of Orrs Creek to determine the current habitat conditions and to make recommendations to enhance habitat for chinook salmon, coho salmon and steelhead trout (Appendix A). In a very draft report on this study, the CDFG noted that in order to provide optimal conditions for fish species habitats in Orrs Creek several improvements to the Creek area were needed:

- More canopy, especially of deciduous trees;
- More shelter, particularly that provided by log and root wad cover;
- More deep pools (2 feet or greater depth).

Specific recommendations by the CDFG included monitoring fish passage along the Creek and mapping and prioritizing sources of erosion, both in the Creek and relating to the road systems near the Creek. Increasing canopy by planting deciduous trees and other woody cover and planting a riparian buffer that would increase bank stability and provide protection from agriculture, grazing and urban runoff were also recommended by the CDFG.



4a SECTION @ "W" ROCK WEIR (NS)



4b PLAN - "W" ROCK WEIR (NS)

FROM:
 Rosgen 1993
 Applied River
 Morphology 1996

CREEK IMPROVEMENT PLANS

UKIAH - ORRS CREEK
 BRADY - USA

4

JULY 99

Other CDFG suggestions included utilizing natural materials at hand (large tree branches and stumps) to provide cover/scour structures in the upper reaches of Orrs Creek to enhance habitat conditions for salmonids, and installing structures such as "W" stone weirs (See Figure 4) to increase the number of deep pools, as well as structures to decrease channel incision and recruit spawning gravel to enhance salmonid spawning habitat. Floodplain benches could be reestablished and a low flow channel defined by the use of bio-technical vegetative techniques.

4. CDFG/City Gravel Agreement

According to Jim Looney of the Ukiah Department of Public Works, the State Bridge Inspectors have historically said that the level of gravel had to be near the bottom of the culverts of the Oak Street bridge. The CDFG and the City discussed the Creek problems and agreed to leave the gravel over the 1998-1999 winter season to observe whether the gravel caused any flooding problems. Unfortunately, the Public Works crew removed the gravel from Orrs Creek after mis-communication with CDFG field staff. When others at CDFG discovered the removal, they were disappointed that the gravel/flooding concerns could not be studied.

5. Brady/LSA Study

In February 1999, in response to the various concerns about Orrs Creek, the City hired Brady/LSA to investigate the implementation of flood control measures which would offer habitat enhancement benefits. Specifically, Brady/LSA would do limited site mapping and document review for the area. They would then make recommendations for a creek management and restoration pilot project for Orrs Creek. The Bush Street to State Street reach of Orrs Creek was selected for the Brady/LSA pilot project. This project consisted of a reconnaissance-level evaluation of current conditions, opportunities, and constraints, and the formulation of management recommendations.

Brady/LSA also facilitated talks between CDFG, the Department of Public Works and Alta California Associates to come to an understanding of the Creek problems and a direction for the solution. Rick Kennedy, Public Works Director, and Charley Stump, Senior Planner for the City, explained the misunderstanding over the gravel removal to CDFG representatives and committed the City to work in cooperation with the CDFG toward a solution.

C. Ukiah Valley General Plan Goals

The Ukiah Valley General Plan recognizes urban creeks as significant natural resources which must be preserved and restored where possible. The Plan specifies in Section 1.03, *Creek and Streams* that creeks and streams must be preserved or, where necessary, restored as corridors of riparian vegetation and habitat within both urban and rural areas. The specific General Plan goal (Goal OC-9) is to "conserve and enhance channels for creeks and waters flowing through the Planning Area."

To attain this goal, the Plan proscribes a *Stream and Creek Master Plan* (Master Plan) that outlines a stream maintenance program and calls for hydrological studies and an ecosystem analysis of streams and creeks in the Planning Area. The Master Plan should also include an access plan to develop pedestrian access and pocket parks near streams and creeks, and protection for streambeds and riparian vegetation buffers around these beds.

Generally, the Plan advises maintaining and enhancing streams and creeks both as fish habitat and as an amenity for the City. All City, County, and State agencies involved in stream related activities should work together to maintain and enhance the streams and creeks for fish habitat, and to ensure that flood control characteristics are not impeded by restoration efforts.

Building and development codes and Streambed Alteration Agreements should include cooperative agency review procedures to ensure protection and enhancement of streams and creeks, and to provide contiguous riparian corridors around streams and creeks. The Master Plan also specifies that information on riparian plants and funding sources and incentives for property owners should be made available to citizens (Appendix B).

D. Oak Street Bridge: Overview and Recommendations

The most serious problems in the study area relate to the Oak Street bridge area. These problems stem from the 1967 alteration in the streambed. The disruption in the intricate balance of channel width, depth, and flow direction has led to gravel deposition below the bridge. This gravel deposition combined with stream gravel removal has led to stream bed erosion and habitat degradation for fish and aquatic life. The City's gravel removal policy was initiated after the streambed alteration in 1967 to answer safety concerns about the Oak Street bridge.

Biennial reports by the California State Department of Transportation (CalTrans) bridge inspectors encouraged this policy. According to the City Public Works

Department, the bridge inspectors required that the City keep the gravel level near the bottom of the culverts. Reports of heavy rusting on the structural arch plate of the Oak Street bridge appeared as early as 1976.

The Caltrans Supplemental Bridge Report dated 6/11/92 certified that the rusted areas had been tested and that no significant deterioration was found, and that the arch plate geometry was in good condition. A subsequent report dated 2/11/94 concurred with these findings. This later report also mentioned exposure of the top and sides of the upstream portion of Bent 2 and the downstream end of Bent 3. It recommended monitoring of this condition. Subsequent reports made no mention of the arch plate rust or footing exposure.

1. Future Steps

Brady/LSA makes the following recommendations to alleviate the problems at Orrs Creek at the Oak Street area:

a. Survey Benchmarking. The study area should be surveyed and marked to determine how gravel removal affects the problems of the Creek. Creek function and stability, as well as the success (or failure) of management actions, could be tracked by the topographic survey. Tracking can be accomplished by identifying or developing permanent bench marks on stable sites above both sides of the active channel. These reference elevations can then be used to establish channel cross sections to assess the channel's vertical stability over time. At least two cross sections should be established within the study reach: one cross section should be centered on the gravel aggregation area downstream of the Oak Street Bridge and another above the Oak Street Bridge. These cross-sections should be mapped and measured annually at the end of the storm flow season using a level/tripod survey or a cross section plotting and computation program such as R2-CROSS-81.

In addition to cross sectional data, water surface elevations should be measured on both systematic and event bases. These measurements can be easily obtained by establishing permanent staff gauges or painting elevation marks (in tenths of feet) on the upstream and downstream faces of bridges and flood walls. These can easily be recorded by City staff during storms as they check for debris that clog the culverts.

b. Bank Stabilization. Due to the deflection of creek flow by the angle of the three culverts within the Oak Street bridge, flow currently attacks both banks during high water events. The eroding wooden cribwall at Oak Street can serve as a demonstration project for a native material revetment. A native material revetment provides bank stabilization while providing a natural appearance and enhancing the variability and quality of fish habitats. This is accomplished by placing a "footer" log at the bottom of the current thalweg, anchoring the footer

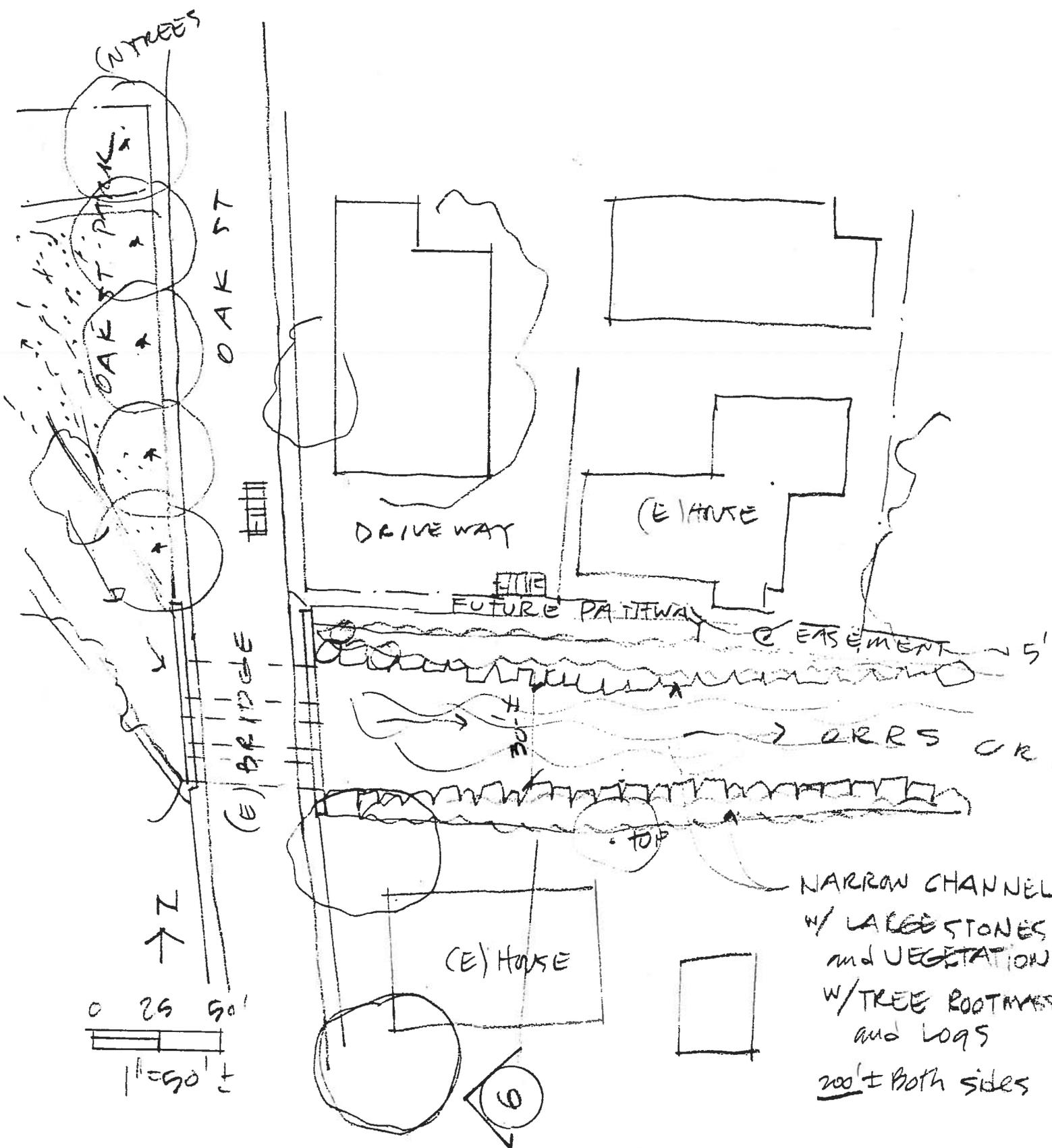
with large boulders, and placing root wads (i.e., logs with root masses intact) at the bankfull stage (high water erosion/discharge level) elevation (see Figures 5 and 6).

Elsewhere along Orrs Creek, representatives of the CDFG and City Public Works' staff should identify and remove dead trees and large branches in the Creek corridor. Large logs should be evaluated for possible use as native material revetment in the Oak Street Bridge area. Above these structural components native plant materials can be planted to provide sediment control and water quality protection.

To alleviate the gravel accretion problem the channel can be narrowed below the bridge by placing large boulders on either side of the channel at and beyond the existing concrete cribwalls. Narrowing the channel would force the water through the bridge culverts at higher velocity, limiting the deposition of gravel in the area just beyond the bridge. The gravel would naturally deposit farther downstream. This will both prevent streambed erosion and improve salmonid habitats.

c. Channel Narrowing. To ameliorate the Creek problems entirely, the Oak Street bridge could be removed and replaced with another structure similar to the Bush Street clear span. If the bridge had an open span over the Creek, the debris from winter storms would likely deposit at the edges of the channel, providing erosion protection and narrowing the channel at that point. The channel should be narrowed to increase water flow velocity so that gravel would not be deposited below the bridge but would continue on downstream. In lieu of either replacing or removing the bridge, the solid concrete railing might be replaced with a more open design, providing views of the Creek to passers-by and lessening the impact in the event of a flood by providing flow-through at street level. A structural engineer would need to make specific recommendations for this railing change.

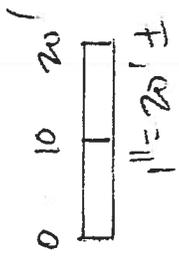
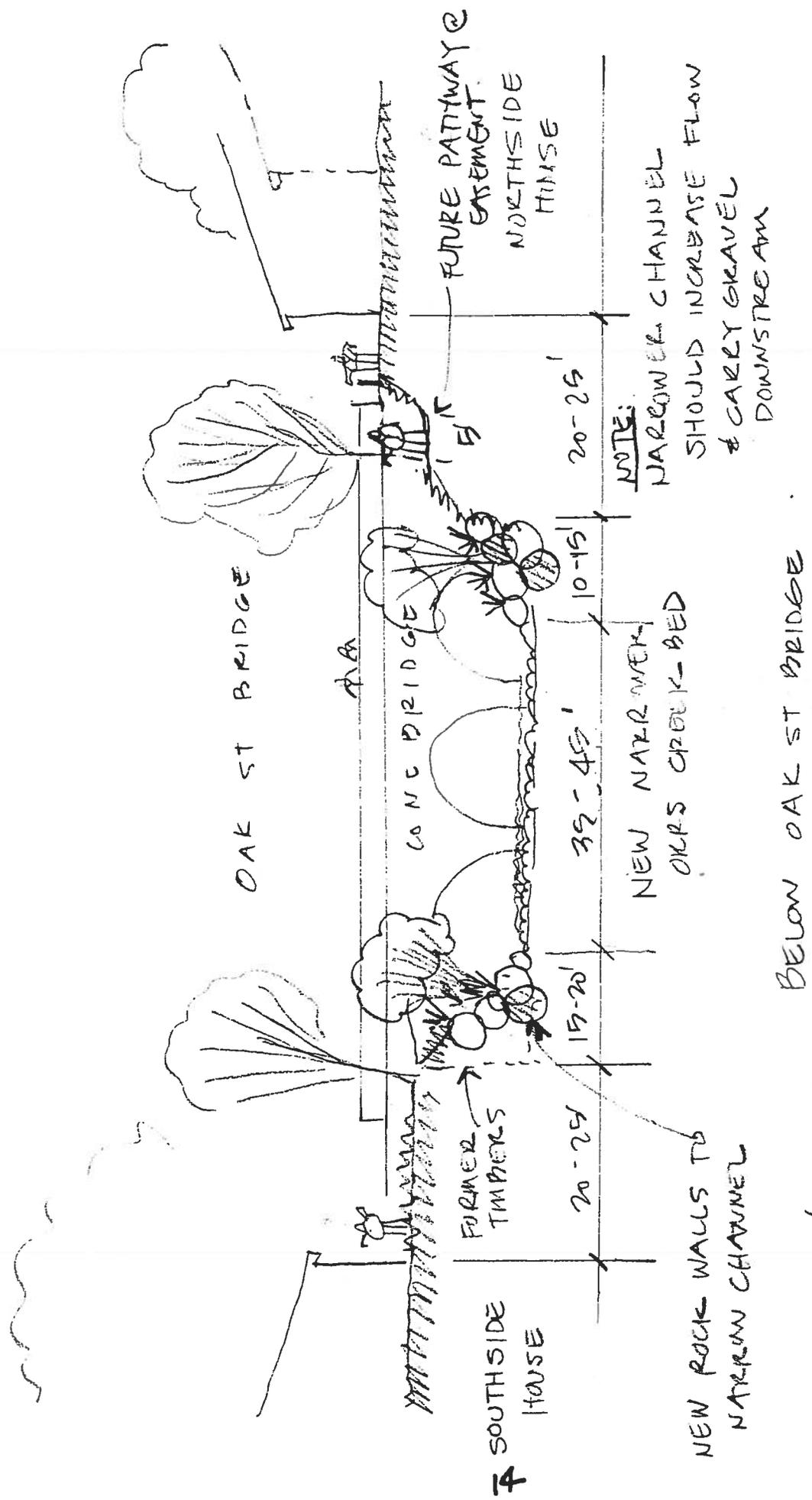
d. Park Proposal. The area above the Oak Street bridge would be an ideal place to develop a park. The site could be graded to provide gently sloping access to the Creek, with room for play, picnicking, and other creekside activities. (Figures 7 and 8) If the bridge was removed, a larger park could be developed.



CREEK RESTORATION BELOW OAK ST. BRIDGE
 SCHEMATIC PLAN - PROPOSED

UKIAH CREEK
 BRADY, USA

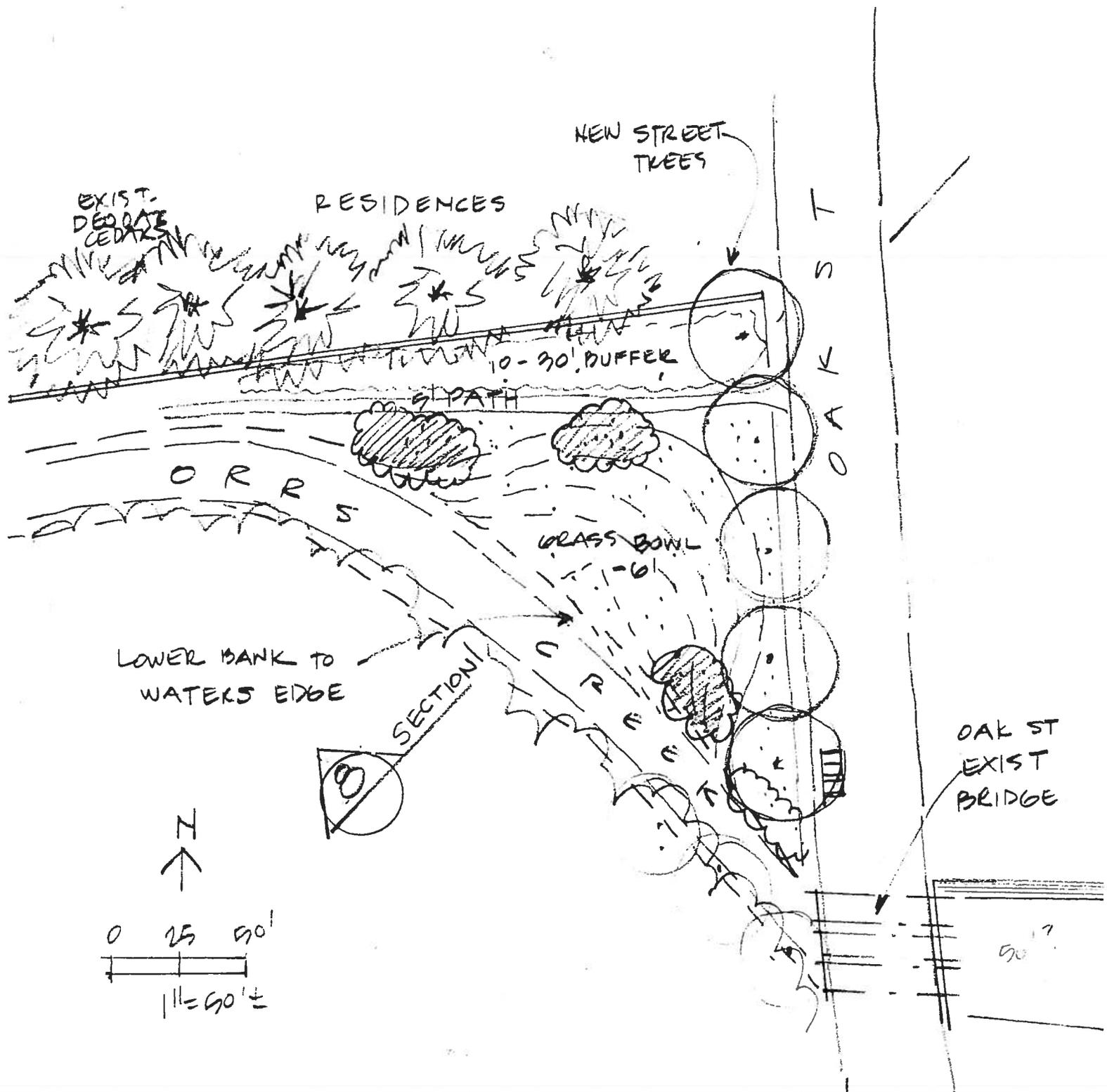
JULY 99



BELOW OAK ST BRIDGE

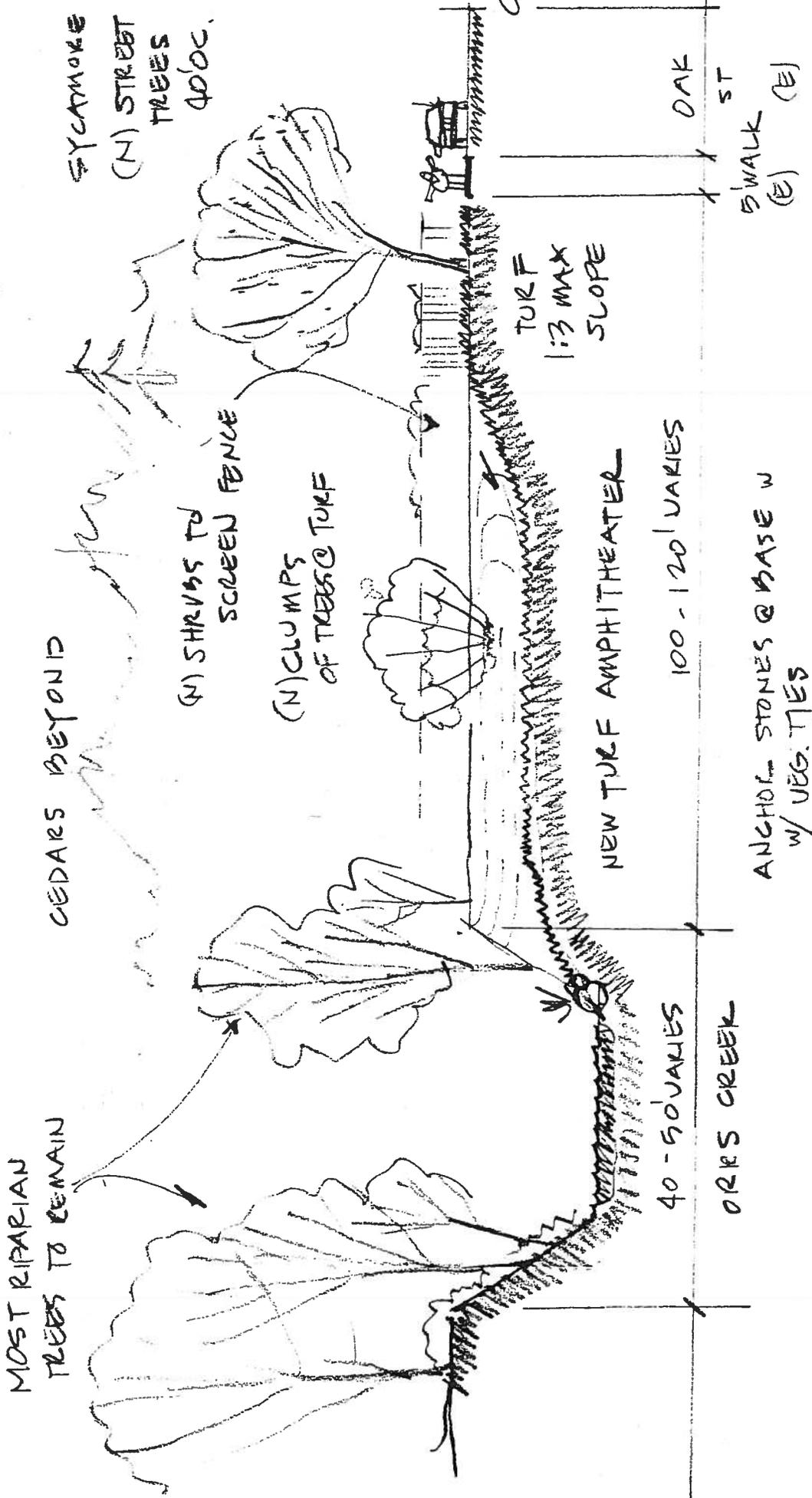
SECTION - PROPOSED

UKIAH OAKS CREEK
BRADY USA



PROPOSED PARK ABOVE OAK ST.
SCHEMATIC PLAN

UKIAH ORRS CREEK HABITAT / FLOOD
 BRADY LSA JULY 99



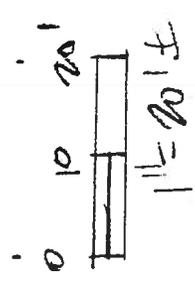
6

PROPOSED PARK ABOVE OAK ST.

SECTION 2 PARK

UKIAH ORKS CREEK HABITAT / FLOOD
 BRADY USA
 JULY 99

8



This park area would provide many benefits. The area could be cut down 3 to 5 feet, creating a natural bowl adjacent to the creek. The bank steepness could be reduced in half, providing better pedestrian access to the water. During floods, this depressed area could store some of the excess floodgates. Native trees such as cottonwood, alder, oaks, and buckeyes could unite the water perimeter of the bank. The park would also serve the local neighborhood with an open turf area with summer irrigation and weekly mowing.

2. Other Recommendations for Orrs Creek

In addition to the changes recommended for the Oak Street area, Brady/LSA makes the following recommendations for Orrs Creek:

a. Bush Street Bridge. Limited City right-of-way at the left bank of Orrs Creek at the Bush Street bridge constrains public access to the creek corridor (Figure 9). The City should explore the use of a wider easement for the area between the Bush Street span and the terraced river bank area (Figure 10).

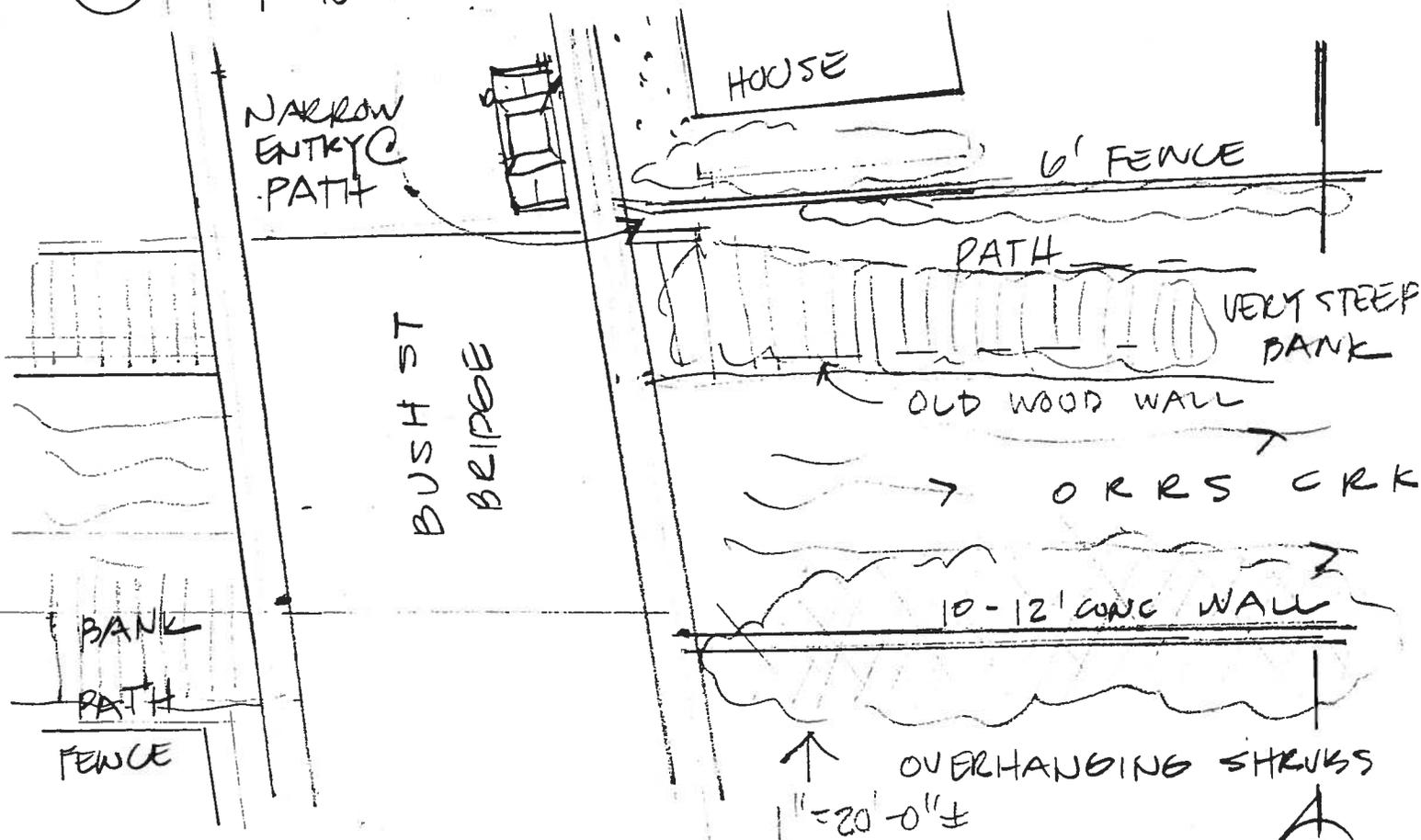
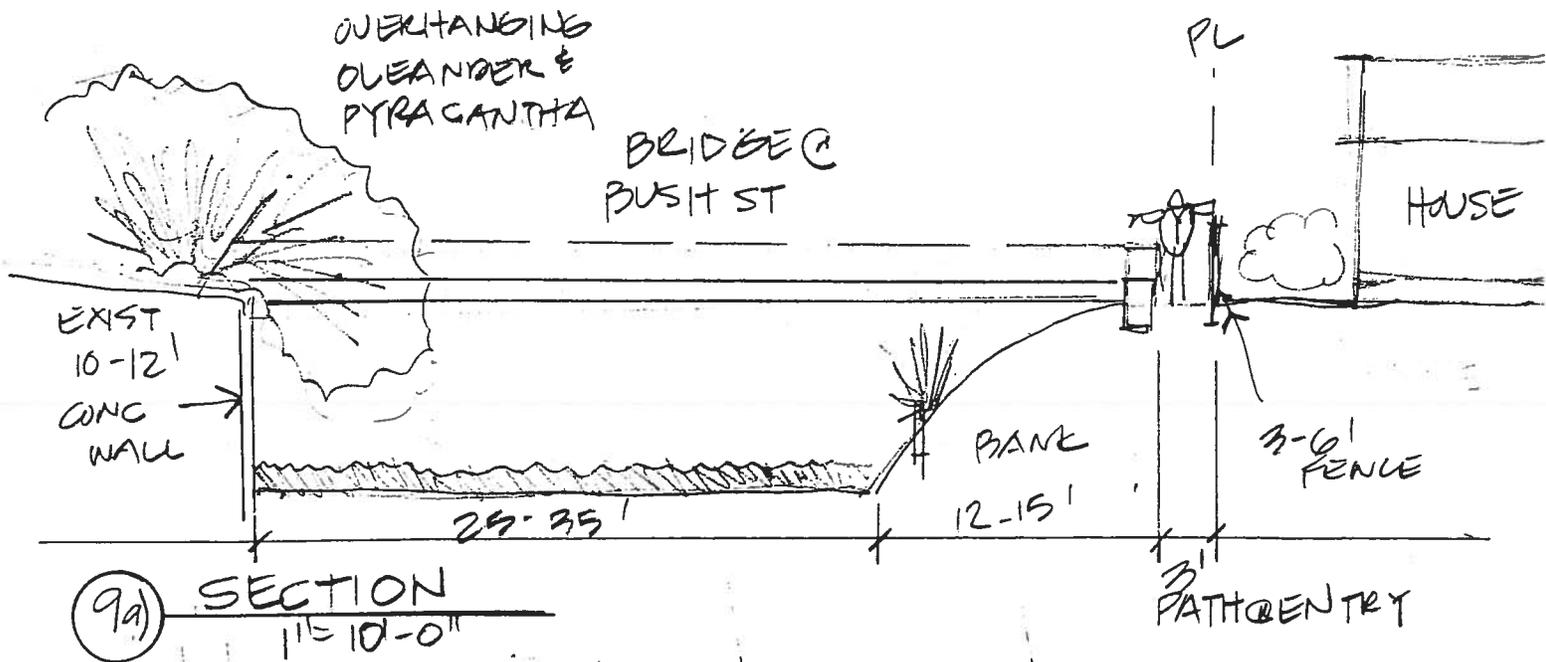
The concrete retaining wall on the south side of the Bush Street Bridge should be strengthened and softened with rocks and native plants. The overhanging pyracantha and oleander should be cut back. The pathway between Bush and Oak Streets should be lowered 3 to 6 feet to provide privacy for adjacent houses and a larger flood zone. New plantings and stones should line the toe of the steeper bank, replacing sagging wooden retaining walls (Figure 11).

b. State Street Bridge. The existing hotel above State Street has extensive concrete retaining walls topped by 6 foot fences at the water's edge (Figure 12). These walls and fences make a hard edge to the creek, and the fences block views of the creek below. They are all in poor condition. (Figure 13).

Access to the creek at State Street could be improved by removing concrete retaining walls and 6 ft. wooden fences. The empty hotel pool, pool house and leaning two story apartment building could be either renovated or removed and the area landscaped to visually connect the hotel to the creek (Figure 6). The newly developed open area would be ideal for a restaurant or other business that would benefit from the view of the Creek. Below the State Street Bridge, the existing apartment complex has a 6 foot wood slat cyclone fence. Views from the apartments and gardens could be improved by replacing existing solid fences with open fences and installing riparian native plantings along the stream banks.

Across from the apartments on the north Bank, a small cottage fronts onto the creek. The adjacent Health Club has extensive parking against the edge of the steep bank. The parking should be reconfigured to provide for a new lower creekside path and future outdoor dining uses (Figure 14).

c. Railroad Bridge. Views of the creek by the railroad bridge could be easily improved by protecting the metal cribbing with boulders and riparian plants. Debris, metal scraps and concrete rubble could be cleared from the creek by scouts, volunteers and CCC crews.

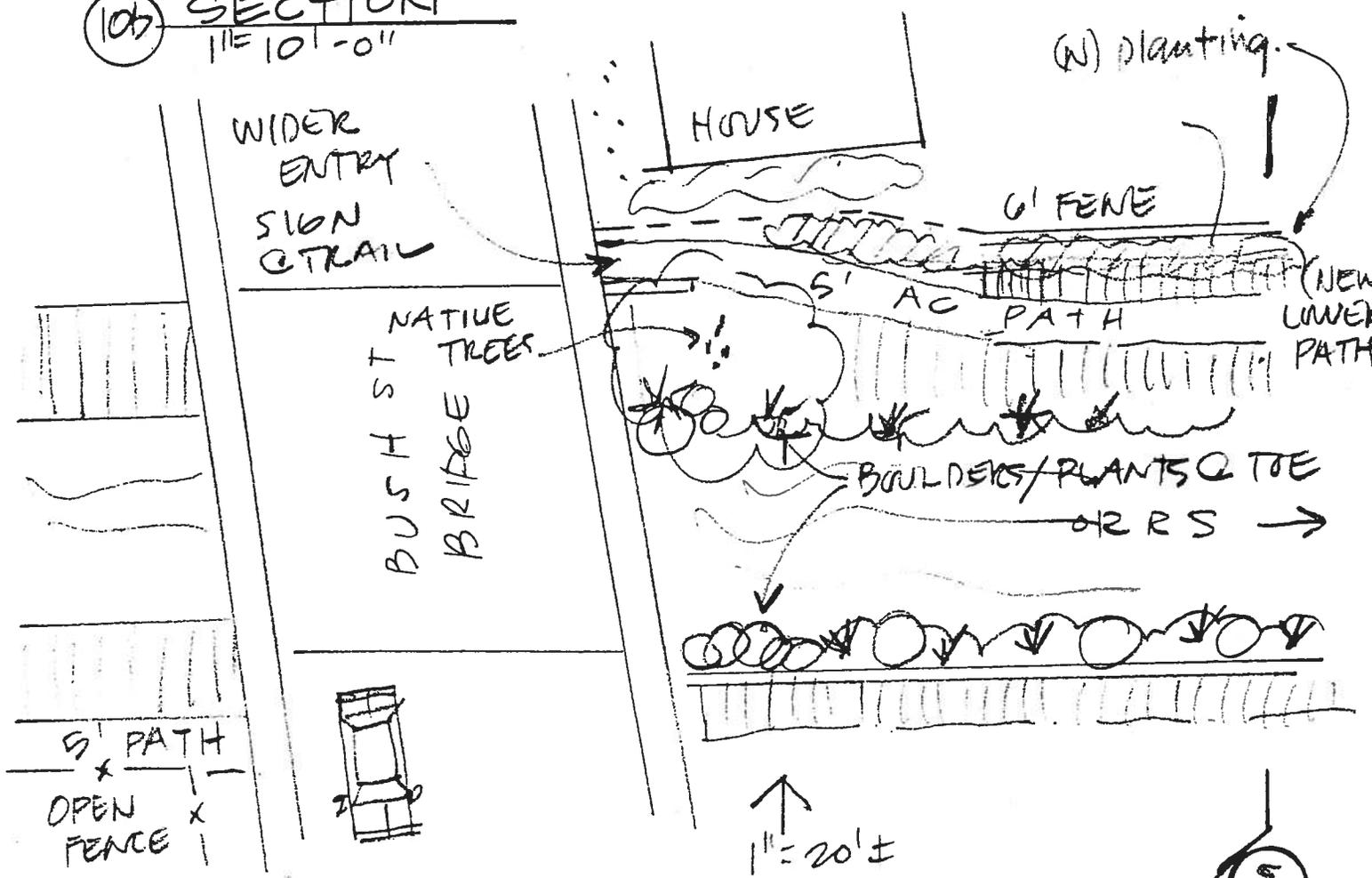
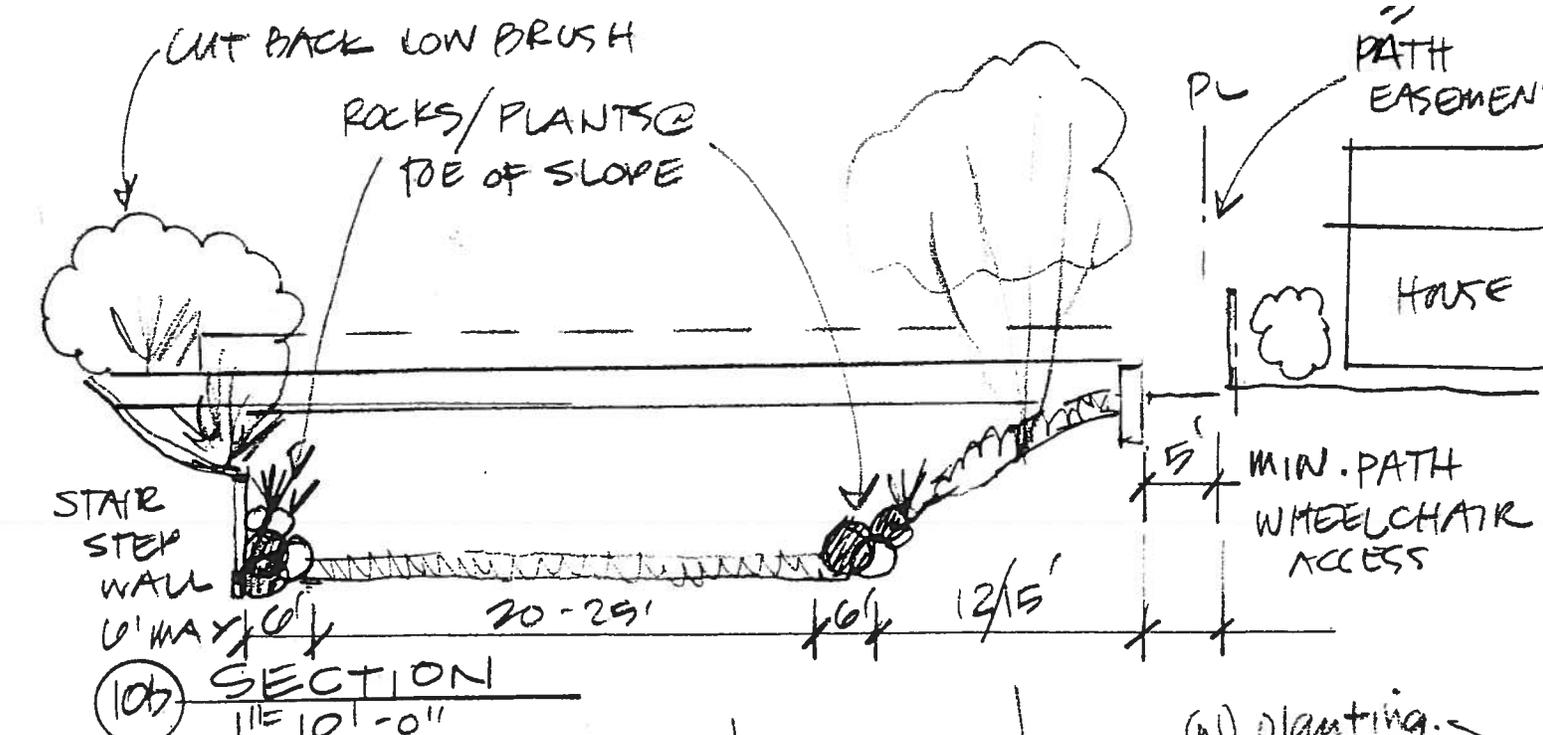


BUSH ST BRIDGE - PEDESTRIAN PATH
 SCHEMATIC PLAN - EXISTING

UKIAH ORRS CREEK
 BRADY USA

JULY 99

9

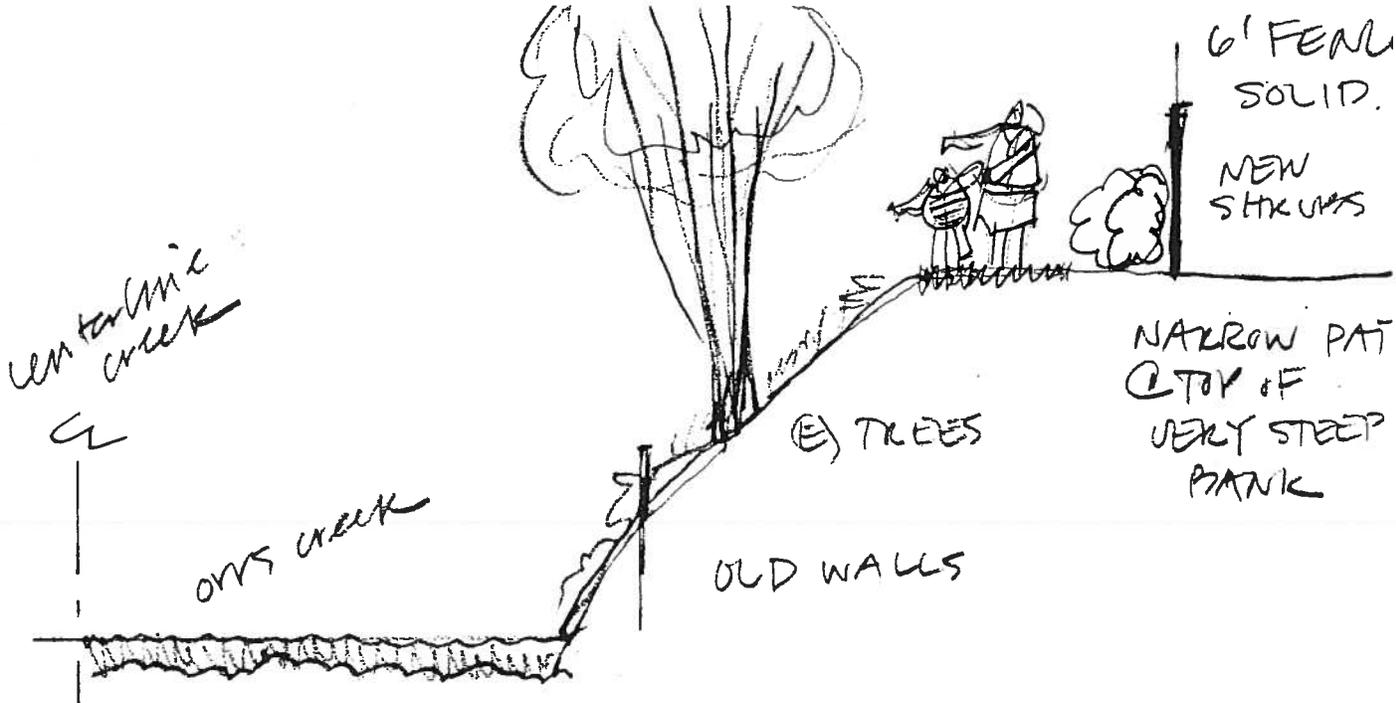


BUSH ST BRIDGE - PEDESTRIAN PATH
SCHEMATIC PLAN - PROPOSED

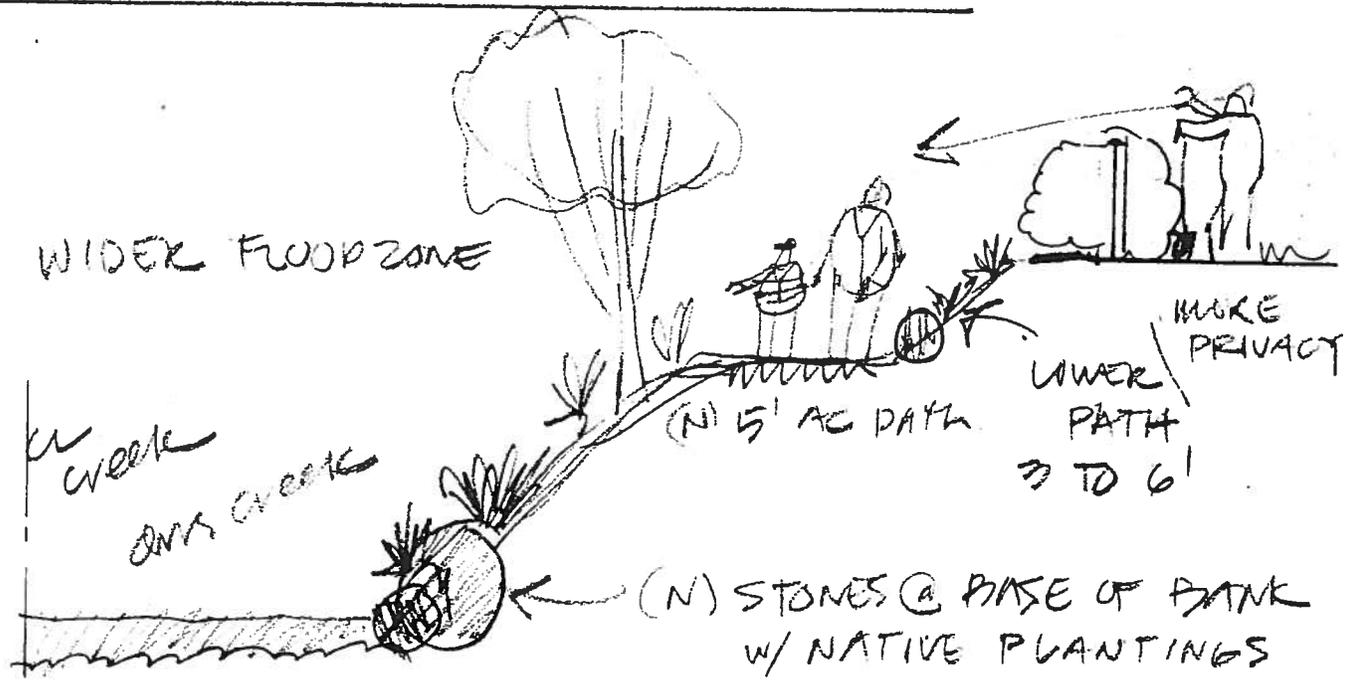
UKIAH ORRS CREEK
 BRADY LSA

JULY 99

10



11a. 1/2 SECTION - TYPICAL BANK



11b. 1/2 SECTION - REVISED BANK

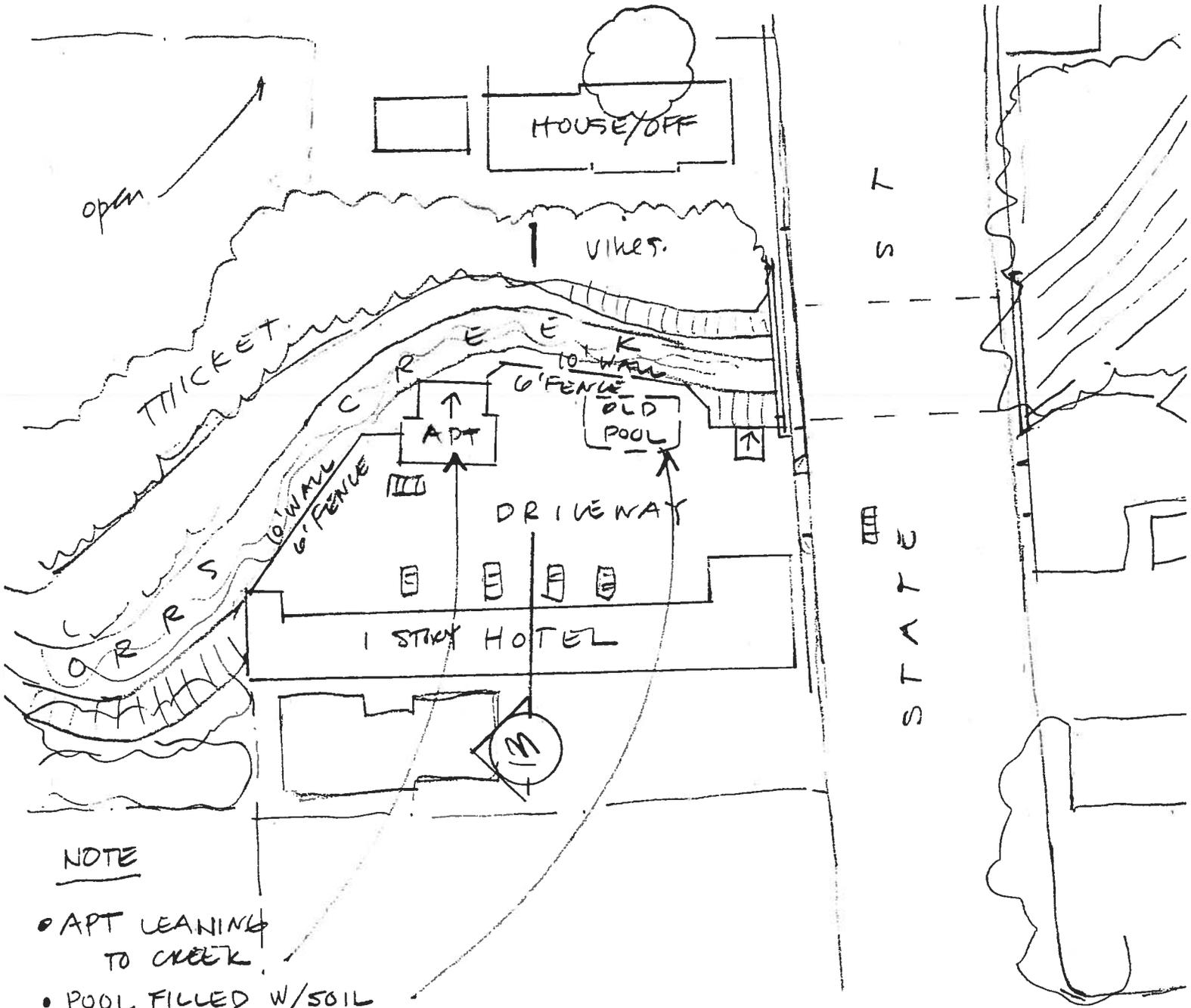
PATH OPTIONS

SCHEMATIC SECTIONS

UKIAH ORRS CREEK
BRADY. LEA

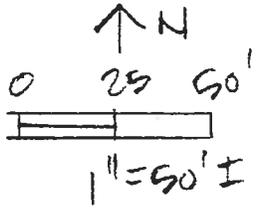
JULY 99

11



NOTE

- APT LEANING TO CREEK
- POOL FILLED W/SOIL
- CREEK WALLS LEANING



EXISTING HOTEL ABOVE STATE ST.

SCHEMATIC PLAN -

UKIAH ORRS CREEK
BRADY - USA

JULY 99

22

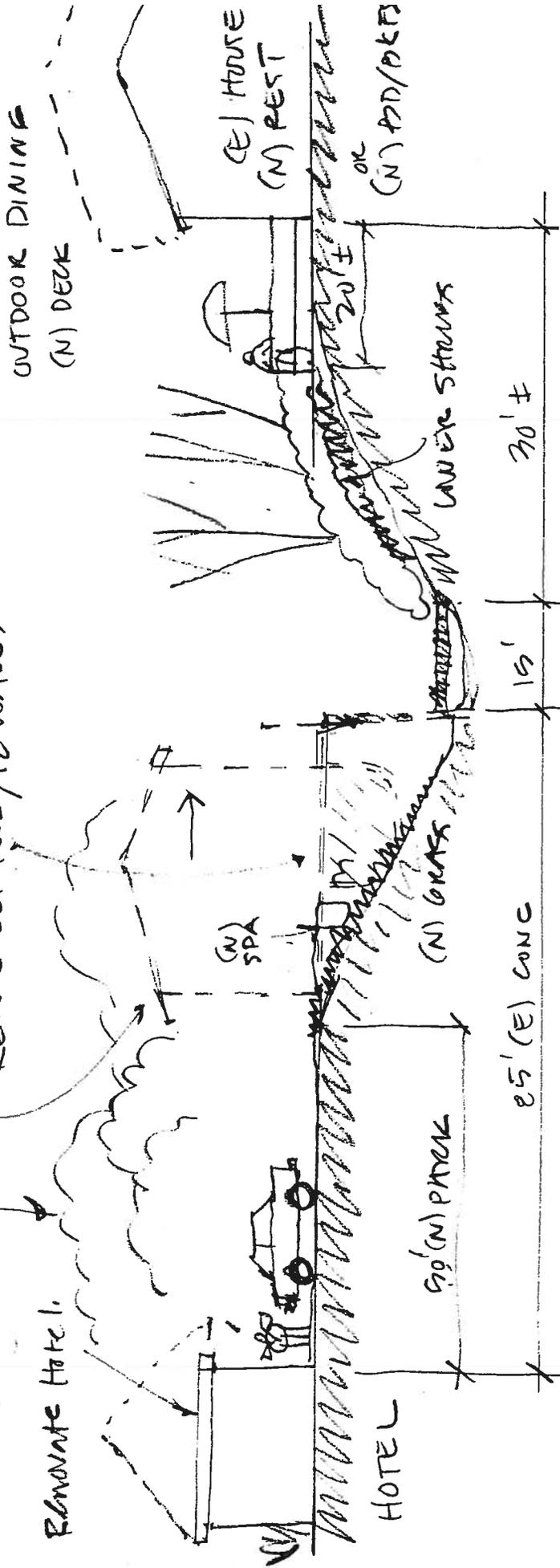
12

NEW TREES TO SHADE HOTEL/PARKING

INCREASE CHANNEL WIDTH

REMOVE APT REMOVE OLD POOL/12' WALKS

RENOVATE HOTEL.



23

ABOVE STATE ST. BRIDGE

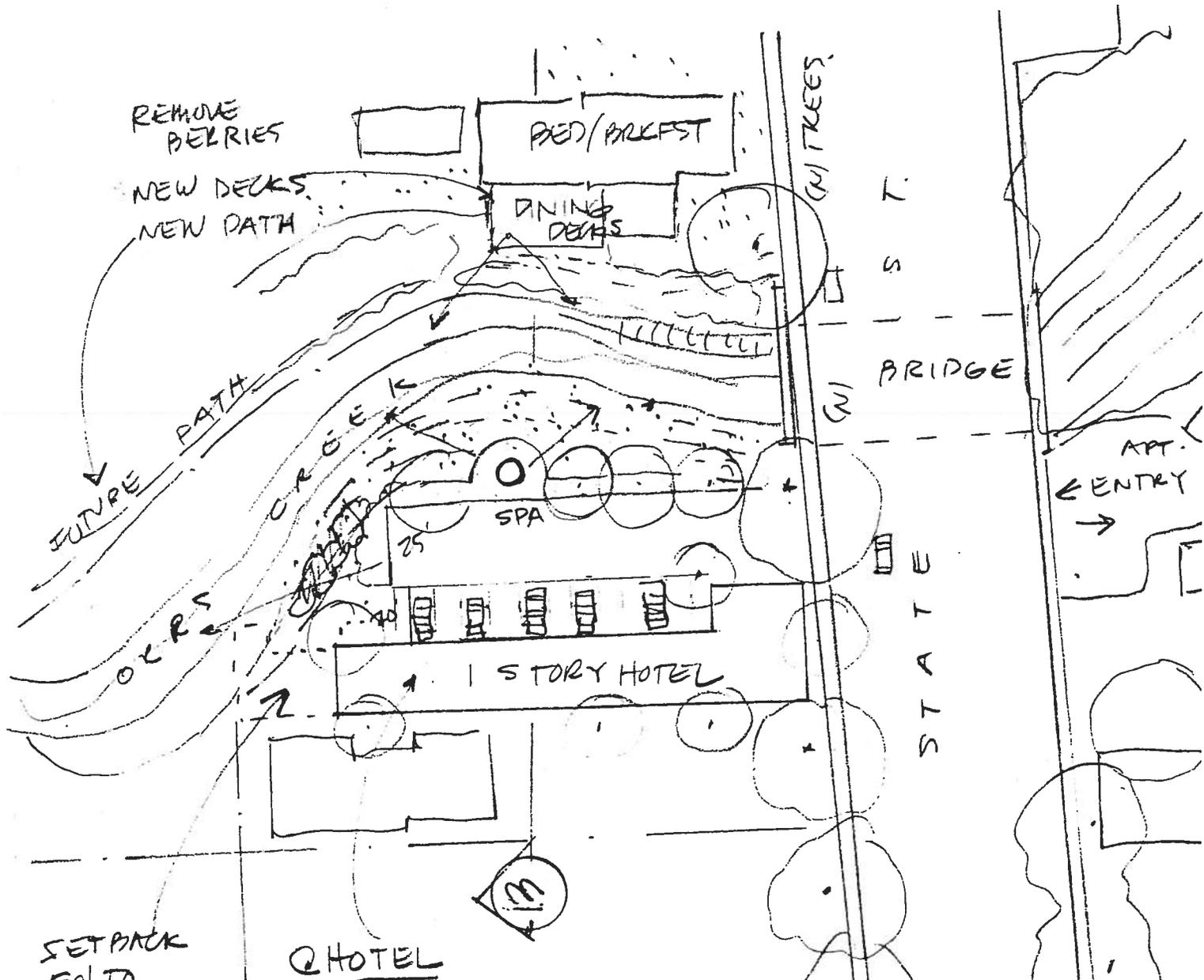
SECTION - EXIST/PROPOSED

ULIAH ORRS CREEK
BRADY USA

(N) WIDEN CREEK CAPACITY

13

JULY 99



REMOVE BELRIES

NEW DECKS
NEW PATH

BED/BREAKFAST

DINING DECKS

(M) TREES

S T.

BRIDGE

FUTURE PATH

ORRS CREEK

SPA

1 STORY HOTEL

STATE

APT. ENTRY

SETBACK
50' TO
CREEK
EDGE

Q HOTEL

- REMOVE APT/30' OF HOTEL
- REMOVE OLD POOL
- REMOVE 10' CREEK WALLS
- NARROW DRIVEWAY
- NEW GRASS BANKS TO CREEK 3:1
- NEW COLOR/PERENNIALS
- NEW SPA
- WIDER FLOODWAY

PROPOSED HOTEL/ABOVE STATE ST
SCHEMATIC PLAN

UKIAH ORRS CREEK
BRADY, USA

14

E. Conclusion

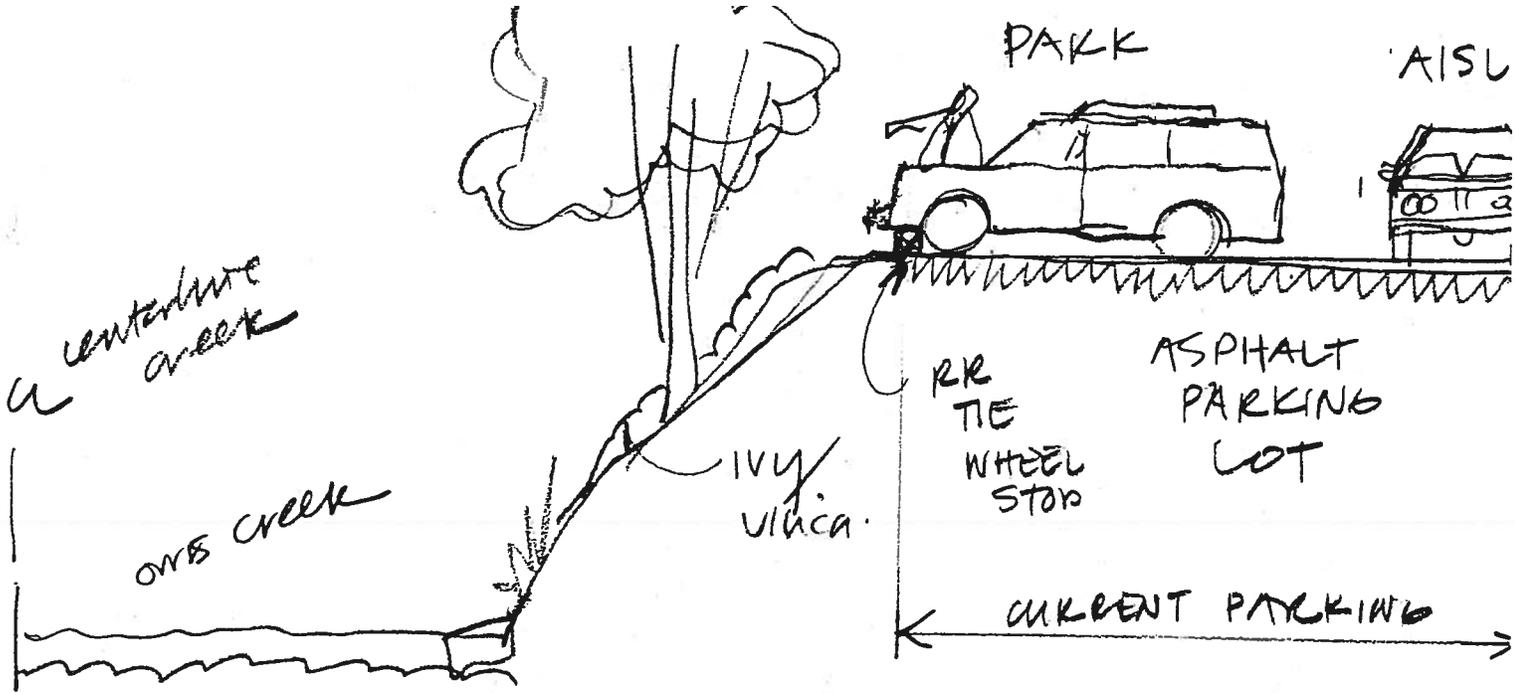
The City of Ukiah is committed to improving those of its streams and creeks that flow into the Russian River. The Orrs Creek reach from Bush Street to the railroad tracks has a number of problem areas that can be improved over time. The 1967 creek straightening above the Oak Street Bridge created a gravel deposition area that has threatened the bridge. On-going discussions with the City, consultants, and the California Department of Fish and Game has resulted in a moratorium on gravel removal, combined with bank and riparian improvements. It will be important to survey a series of benchmarks to compare future changes in the creek bottom and gravel layers.

Other creekside improvements are diagramed, including a better park and creekside paths above Oak Street and entrances near Bush Street. At State Street, the opportunity for creekside improvements should enhance the hotel and provide better flood control (Figure 15). Below State Street, the riparian corridor is ideal for pathways and outside dining. The combination of these changes would dramatically improve the entire area.

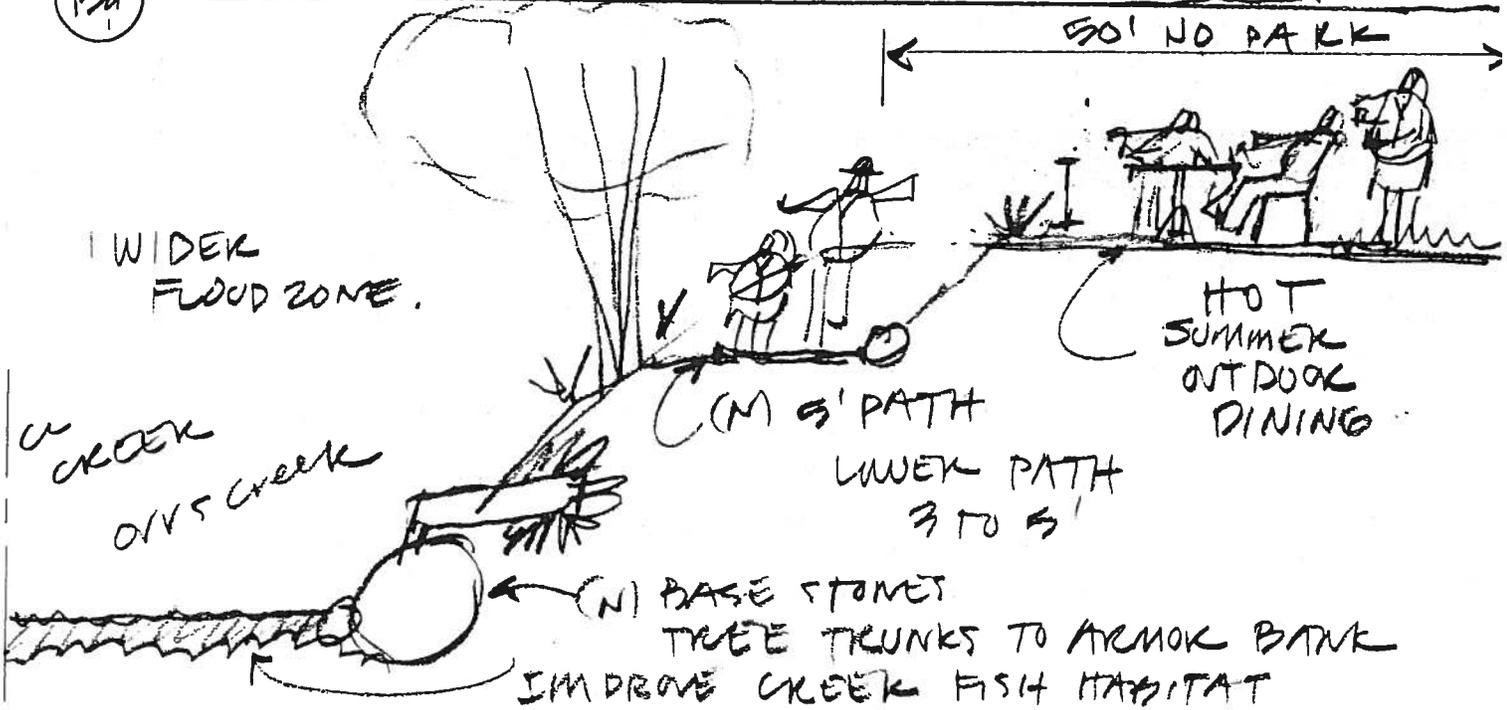
Ukiah is fortunate to have several scenic and historically interesting creeks that link the City to the Russian River. By developing and implementing a *Streams and Creeks Master Plan*, the City can maintain and enhance these natural assets. The City's *General Plan* policies essentially directs the preparation of a Master Plan. These policies include:

- OC-9.2- Maintenance programs, ecosystem analysis and hydrological studies for stream channels;
- OC-9.3- Ensure creek restoration programs, don't interfere with existing and future floodgate carrying capacities;
- OC-9.4- Develop a stream access plan; and
- OC-9.5- Establish water course protection areas with construction limits to provide protection for riparian vegetation and stream banks.

The *Master Plan* should provide guidelines for setbacks from creek banks, encourage pedestrian access to the creek edges and help individual property owners design and maintain safer structures and plantings along creekside properties. Restoring the creeks to a more natural state will provide better habitat for native fish and other species, ensure better flood control for the City, and enhance the scenic amenities of the creeks. The City can reap the benefits from creek restoration economically and aesthetically.



15a 1/2 SECTION - PARKING BELOW STATE ST.



15b 1/2 SECTION - ALT PARKING LOT USE

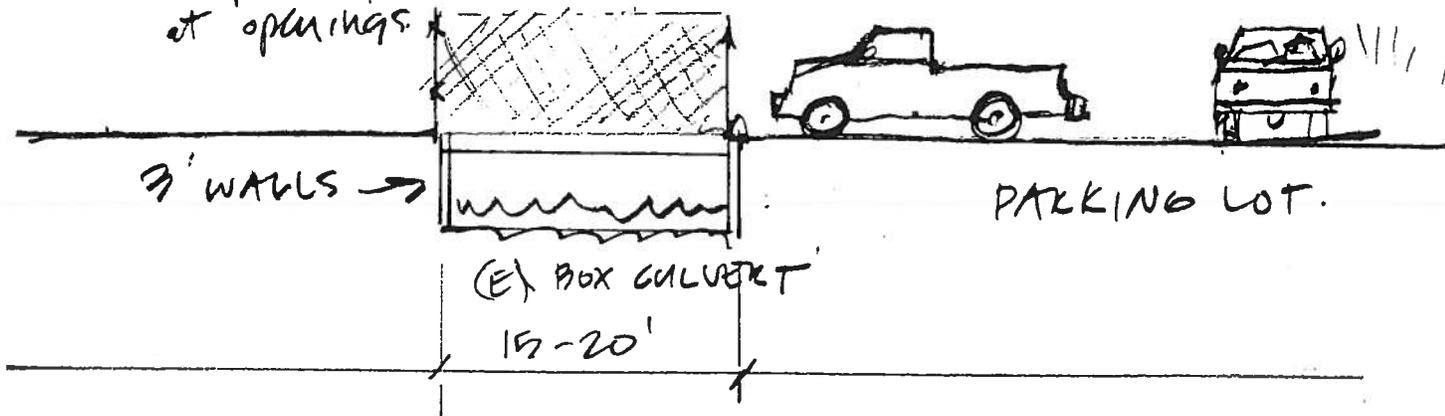
SCHMATIC PLAN

UKIAH ORKS CREEK
BRADY, USA

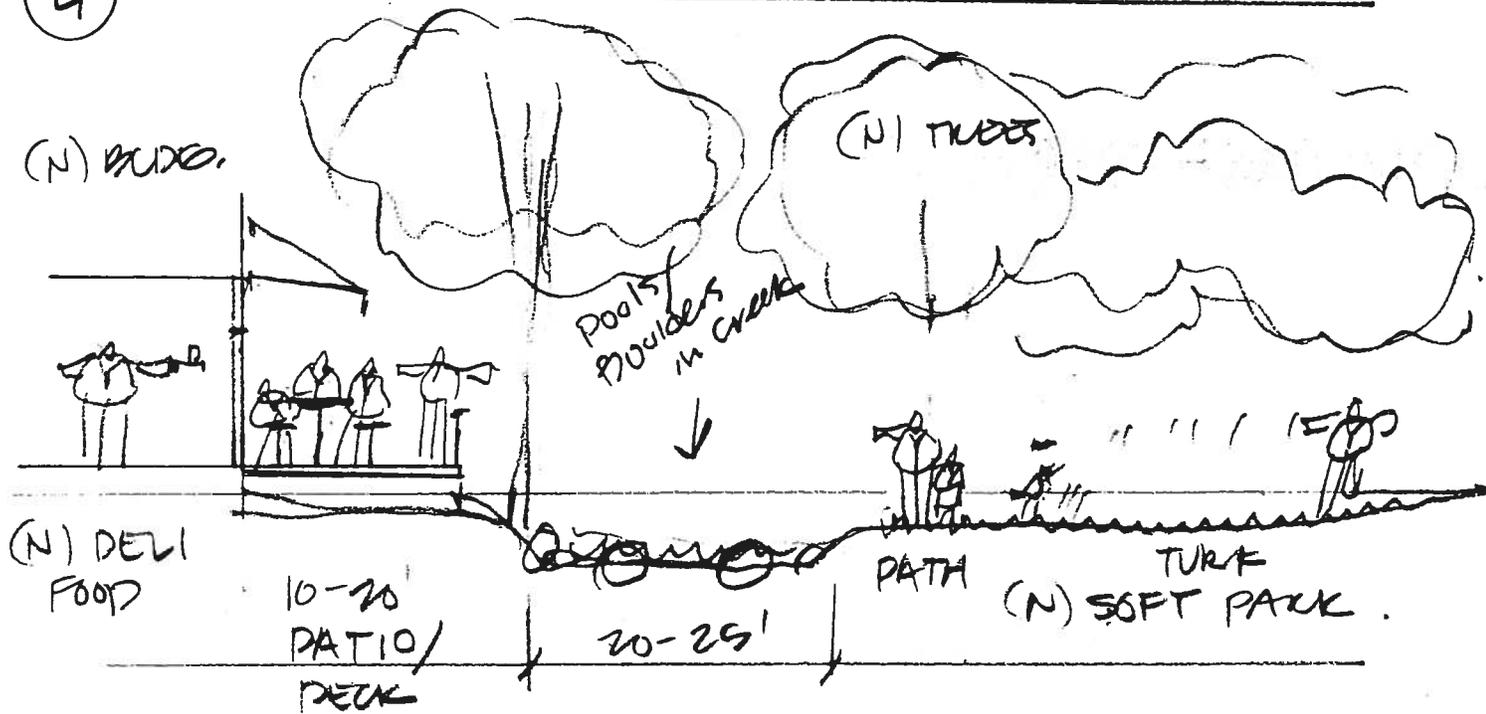
JULY 99

15

6' cyclone fences
at openings.



(L1) SECTION @ PARKING LOT



(L2) SECTION - OPEN CREEK @ DOWNTOWN
1" = 10' - 0" ±

- WIDER FLOOD ZONE
- IMPROVE CREEK HABITAT
- ATTRACT PEOPLE

SCHMATIC PLANS

UKIAH - DOWNTOWN CREEKS
BRADY - LSA

Several other creeks flow through Ukiah south of Orrs Creek: Gibson, Mendocino, and Doolan. Each of these creeks provides an opportunity for specific creekside improvements that would benefit residents and businesses while protecting habitat and improving flood control (Figure 16) These creeks and the opportunities they present should be studied to form a comprehensive city-wide Creeks Master Plan.

Appendix A
CDFG ORRS CREEK SURVEY
RECOMMENDATIONS SUMMARY

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A 1998 survey of Orrs Creek by the California Department of Fish and Game (CDFG) concluded that Orrs Creek should be managed as an anadromous natural production stream. The CDFG recommended the following measures to increase the Creek's viability as a fish habitat:

- Access for migrating salmonids is an ongoing potential problem in Orrs Creek. Therefore fish passage should be monitored, and improved where possible.
- Map sources of upslope and in-channel erosion, and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff.
- In Orrs Creek, active and potential sediment sources related to the road system need to be mapped and treated according to their potential for sediment yield to the stream and its tributaries.
- Increase the canopy on Orrs Creek by planting willow, alder, redwood and Douglas fir along the stream where shade canopy is not at acceptable levels. The non-anadromous reach above the survey section should be assessed for planting and treated as well, since water temperatures throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.
- Parts of Orrs Creek would benefit from the utilization of bio-technical vegetative techniques to re-establish floodplain benches and a defined low flow channel. This would discourage lateral migration of the base flow channel and decrease bank erosion.
- Spawning gravels on Orrs Creek are limited to relatively small areas. Structures to decrease channel incision and recruit spawning gravel

(using gravel retention structures) should be installed to trap, sort and expand redd distribution in the stream.

- Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from vegetation and undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.
- Where feasible, design and engineer pool enhancement structures to increase the number of pools in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- There are sections where the stream is being impacted from livestock in the riparian zone. Livestock in streams generally inhibit the growth of new trees, exacerbate erosion, and reduce summertime survival of juvenile fish by defecating in the water. Alternatives to limit cattle access, control erosion and increase canopy should be explored with the landowner and developed if possible.
- If riparian areas are not improved in some sections of Orrs Creek these sections should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

**Appendix B
GENERAL PLAN POLICIES
AND IMPLEMENTATION MEASURES**



POLICIES AND IMPLEMENTATION MEASURES	
POLICY	IMPLEMENTATION MEASURE
<p>OC-9.1 Establish a <i>Stream and Creek Restoration Master Plan</i> for each creek flowing through the City limits.</p>	<p>(a) In the short term planning period, the City shall establish a citizen's task force for the <i>Stream and Creek Restoration Master Plan</i> and provide staff and technical assistance.</p> <p>(b) The task force's final plan shall include recommendations for private and public funding sources and incentives to property owners to accomplish stream or creek restoration.</p>
<p>OC-9.2 Develop maintenance programs, ecosystem analysis, and hydrological studies for stream channels for creeks and waters through the Planning Area</p>	<p>(a) When maintaining creek and stream channels, the City shall be cognizant of the natural conditions, restoring them whenever possible.</p> <p>(b) During the short-term planning period, wherever feasible and safe, remove barriers and impediments to fish passage following appropriate study of the channel.</p> <p>(c) The City shall maintain information available to the public about the use of riparian plants and vegetation for landscaping, including sources of plant material</p> <p>(d) Ensure that grading and development codes incorporate measures to protect and enhance fish habitat including riparian vegetation protection and restoration and erosion and sediment control measures.</p> <p>(e) Development plans shall be reviewed to ensure that proposals are coordinated with adjoining development in design to maintain or enhance contiguous riparian corridors.</p> <p>(f) Support efforts of appropriate agencies to ensure instream water flows adequate to maintain and protect historic fisheries in the streams and creeks within the Planning Area.</p> <p>(g) Work with the California Department of Fish and Game and community groups to inventory spawning streams in the Planning Area and establish population counts for important fish species.</p>

POLICIES AND IMPLEMENTATION MEASURES	
POLICY	IMPLEMENTATION MEASURE
	<p>(h) During the intermediate and long-term period, the Redevelopment Authority shall consider among its projects the restoration of creeks within its jurisdiction.</p> <p>(i) The City shall develop and implement a review procedure with the California Department of Fish and Game which provides each local agency the opportunity to comment on all proposed Streambed Alteration Agreements in the Planning Area. The focus of this review shall be upon the protection and enhancement of stream and creek natural resources, including fish and riparian vegetation.</p> <p>(j) The City Planning Department shall develop a review and comment procedure with the City Engineer and the Building Official which ensures that all public and private projects in or adjacent to a City stream or creek are designed and approved in a manner which preserves and enhances fish habitat, riparian vegetation, and the natural water course.</p>
OC-9.3 Ensure that creek restoration programs shall not interfere with the existing and future floodgate carrying capacity of creek channels	<p>(a) As a part of stream restoration maintenance programs, the City and County shall ensure that floodgate carrying has not been significantly reduced or damaged.</p> <p>(b) Whenever possible, riparian vegetation shall be used for streambank protection in conjunction with natural materials or appropriate structural material to achieve a natural-looking appearance.</p>
OC-9.4 Develop a stream access plan	<p>(a) Working cooperatively between the City, County, and private landowners during the short-term and intermediate-term planning periods, develop pedestrian access along creeks flowing through the City.</p> <p>(b) During the short- through intermediate-term planning periods, develop <i>pocket parks</i> along creek channels on public lands where feasible.</p>
OC-9.5 Establish water course protection areas with construction limits to provide protection for riparian vegetation and streambanks	<p>(a) The Land Development Code shall include either specified setbacks from streams based on precise criteria or site-specific performance standards for each zoning district.</p>

Appendix C STUDY PARTICIPANTS

■ ■ ■

Ukiah City Council

Jim Mastin, Mayor
Philip Ashiku, Vice Mayor
Phil Baldwin
Kathy Libby
Roy Smith

Ukiah Planning Commission

Judy Pruden, Chairman
Eric Larson, Vice Chairman
Jennifer Puser
Joe Chiles
Mike Correll

Consultant Team

Brady/LSA, Planners and Landscape Architects
 Dave Johnson, Project Manager
 Steve Peterson
 Katherine Donovan

City Staff

Charley Stump, Senior Planner
Rick Kennedy, Director of Public Works
Jim Looney, Public Works Superintendent

State Department of Fish and Game

Bob Coey, Associate Fishery Biologist
Russian River Basin Planning and Restoration
Steve Cannatta, Fishery Biologist

Mendocino County Water Agency

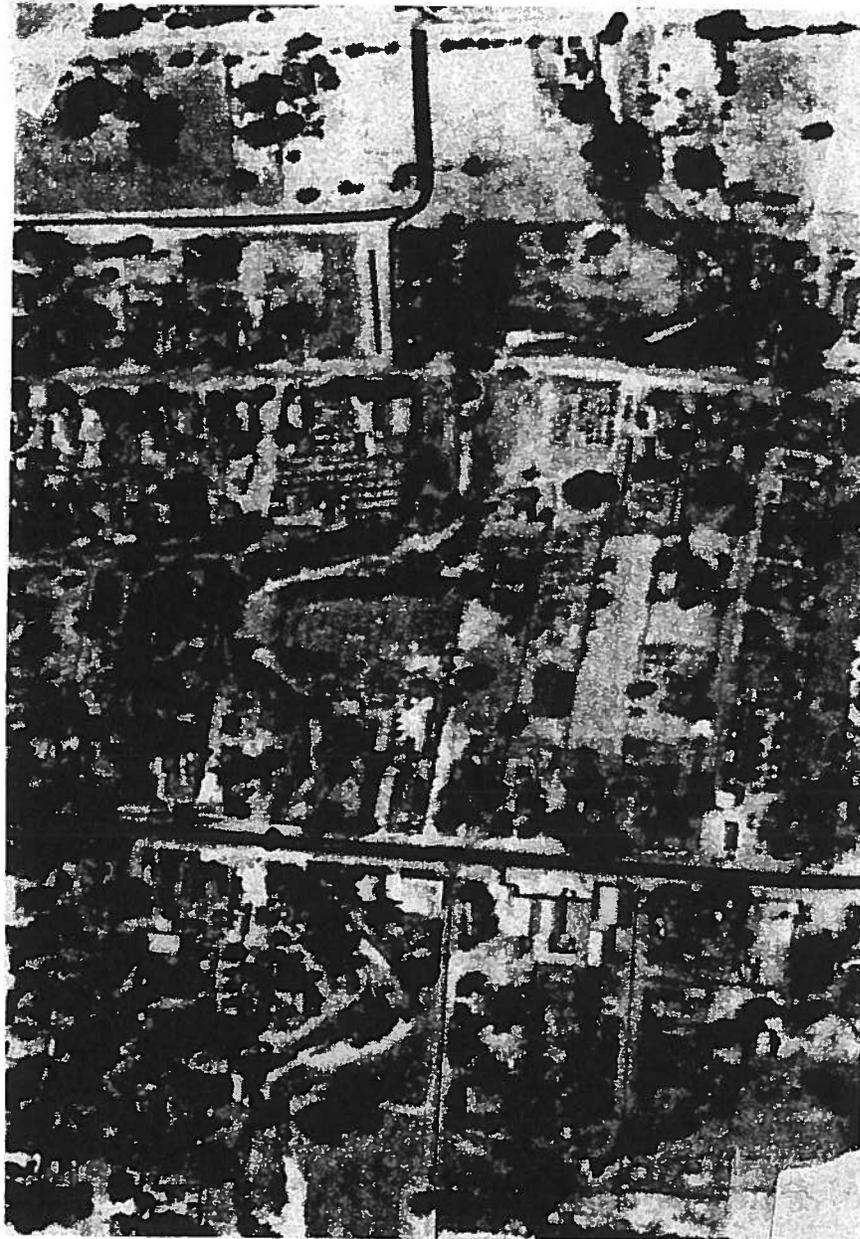
Diane Chocholak

Alta California Associates

Bill Randolph, Principal

Appendix D
AERIAL PHOTOS

■ ■ ■



BUSH

OAK

STATE

R/R

● 1941



BUSH

1967
REALIGNMENT

OAK

STATE

R/R

1992