

MEMO SUMMARY

I Purpose

The purpose of the memo is to develop an implementation strategy for the Bolinas Avenue drainage improvements.

II Background

There is a history of flooding along Bolinas Avenue. Stormwater frequently ponds on the street and crests sidewalks in the vicinity of the Bolinas-Richmond intersection. Landowners report that Bolinas Avenue curb flows flowing toward the intersection from the west sometimes span from curb to curb and overflow the Ross side sidewalks in places to enter low-lying residential properties.

January 25, 2011 Report: The January 25, 2011 study recommended focusing first on reducing frequent ponding at the Bolinas-Richmond intersection. The most cost effective measure for doing that entirely within the public right of way is to install a new large-diameter culvert running under the Ross side gutter from the intersection to Corte Madera Creek just downstream from the Sir Francis Drake Blvd Bridge (Measure 4). The most cost-effective measure for preventing cumulative impacts on Corte Madera Creek peak flows is to install a large subsurface stormwater vault within the right of way (beneath the street) or beneath a parking lot.

February 10, 2011 Council Action: The Council approved a motion to proceed with further analysis and evaluation of the following measures:

- Measure 1 – Cross-street culvert improvements along Oak Ave in San Anselmo (to reduce inadvertent diversions of stormwater onto Bolinas Ave)
- Measure 4 – New large-diameter culvert from Richmond Ave to Corte Madera Creek (to reduce/eliminate ponding at the intersection)
- Measure 4 Bioretention – Landscape the existing Town right of way along SFD Blvd if disturbed by Measure 4 to provide bioretention of stormwater runoff from adjacent parking lot
- Measure 8b – 200,000-gallon minimum subsurface stormwater vault under Richmond Ave near the Bolinas intersection to avoid and minimize cumulative impacts on Corte Madera Creek peak flows of reducing/eliminating the existing frequent stormwater surface pond

III Engineer's Preferred Alternative

Phase 1 Bolinas Avenue Drainage Project:

- Measure 4 – New large-diameter culvert from Richmond Ave to Corte Madera Creek (to reduce/eliminate ponding at the intersection)
- Measure 2j – Affix one-way “flapgate” valve on the end of the existing Bolinas Ave culvert system outfall at Winship Ave Bridge in Ross (to reduce backflow when Corte Madera Creek is running at stages higher than the existing culvert inlets on Bolinas Ave)
- Measure 8b or 8c – 200,000-gallon minimum subsurface stormwater vault under either: (8b) Richmond Ave near the Bolinas intersection; or (8c) under the St Anselm Church Parking Lot near SFD Blvd

IV Project Scope

Combine the Phase 1 drainage as a separate schedule of work under a broader street improvement project which would include the Bolinas Avenue Safe Routes to School project.

The Town will prepare a Request for Proposals (RFP) for consulting services to include engineering design and environmental services.

V Fiscal Impact (draft estimate for budget purposes)

The draft estimate amounts below are based on planning-level design. Engineer’s estimated amounts may differ based on more detailed design. An adequate budget source has not yet been identified to fund the total amount shown. The extent to which the City of San Anselmo should equitably contribute toward the total amount has not been determined.

Engineering & Environmental Services (20% of Construction)	\$ 300,000
Construction (consider adding a 20-25% contingency)	\$1,500,000
Construction Management (7.5% of Construction)	<u>\$ 112,500</u>
Total	\$1,912,500

VI Tentative Schedule

Consultant Selection	Fall 2011
Preliminary Engineering & Environmental Clearance	Summer 2012
Final Design	Fall 2012
Advertise for Construction	Spring 2013
Start Construction	Summer 2013

MEMO SUMMARY

I Purpose

The purpose of the memo is to develop an implementation strategy for the Left Bank Erosion Protection Project at Lagunitas Road Bridge.

II Background

The left bank upstream and downstream from the bridge has been historically prone to bank erosion and bank slump failures. The new effectively wider bridge opening made this condition better upstream from the bridge but worse downstream. Structural (rock) and biotechnical (vegetation intensive) erosion protection is needed to prevent against bank slump failure on Town property and adjacent private property downstream from the bridge. 100% biotechnical erosion protection and installation of appropriate riparian vegetation is still needed upstream from the bridge. An opportunity also exists to blend in hard and/or soft pedestrian trail and creek access improvements into the work needed downstream from the bridge, as may be consistent with future potential development of public park type use (“landscape options”).

III Engineer’s Preferred Alternative

Left Bank Erosion Protection Project:

- “Summer Work” – Biotechnical Bank Erosion Protection Downstream from the Bridge (with landscape options)
- “Winter Work” – Surface Biotechnical Treatment and Vegetation Installation Upstream and Downstream from the Bridge

IV Project Scope

Left Bank Erosion Protection Project:

A permit-level design has been completed and submitted with applicable environmental permit applications in mid-April. Barring unforeseen delays caused by the agencies, all of the necessary permits are expected to be received mid-June to mid-July.

Pending any comments received from the agencies, the permit-level design will need minor design revisions, internal peer review, and some additional design details and construction specifications to be suitable for RFP basis for “Summer Work.”

The permit-level design specifies a plant list and planting zones and biotechnical design details for “Winter Work”, but does not yet include a detailed planting plans and specifications needed to be suitable for RFP for “Winter Work”

The Town will contract necessary Creek Dewatering, Fish Relocation, and Biological Monitoring to Dr. Michael Fawcett (estimated \$8,000 amount not-to-exceed without approval).

The Town will prepare two separate Requests for Proposals (RFPs) for construction services:

- “Summer Work” – General Construction Contractors experienced with creek bank stabilization with preference to experience with biotechnical construction techniques
- “Winter Work” – Landscape Construction Contractors experienced with riparian vegetation installation and surface biotechnical construction techniques.

V Fiscal Impact (draft estimate for budget purposes)

Engineering & Environmental Services (line item estimate excluding landscape options)	\$ 29,500
Construction	
<u>“Summer Work”</u>	\$ 109,000
<u>“Winter Work”</u>	\$ 48,000
(10 percent contingency included in “Summer Work”) (does not include landscape options in “Summer Work”)	
Construction Management (line item estimate excluding landscape options)	<u>\$ 19,500</u>
Total	\$ 206,000

VI Tentative Schedule

Preliminary Engineering & Environmental Clearance	April 15, 2011
Final Design and Advertise for Construction – Summer Work	June 1, 2011
Start Construction – Summer Work	no later than September 15, 2011
Complete Construction – Summer Work	no later than October 15, 2011
Final Design and Advertise for Construction – Winter Work	Sep 1, 2011
Construction Window – Winter Work	Nov 1, 2011 – Mar 1, 2012

MEMORANDUM

TO: Town of Ross Public Works Committee
FROM: Matt Smeltzer
DATE: April 29, 2011
SUBJECT: Implementing Left Bank Erosion Protection Project Downstream from Bridge

(1) Need. The replacement bridge has a wider effective opening, which has allowed the creek to more strongly meander and increased bank toe erosion pressure along the toe of the left (east) bank downstream from the bridge. Continuing erosion appears imminent, as may include destabilization of the steep, poorly vegetated section of stream bank immediately downstream from Town of Ross property, at 29 SFD Blvd. An erosion protection project can be designed and constructed entirely on Town of Ross property that would accommodate a small amount of additional bank toe erosion for habitat improvement but check future excessive bank erosion on both Town of Ross and 29 SFD Blvd.

- *The project should be constructed during the 2011 dry season so that the potential bank failure(s) on both Town and private property is reduced during the 2011-2012 rainy season.*

(2) For Budget Planning Purposes: General Range of Construction Costs for Bank Erosion Protection. A basic rule of thumb from about 6-7 years ago was that minimum bank erosion protection project construction costs were cresting about \$1,000 per lineal foot of stream bank treated. Costs have steadily increased since by normal inflation and also because resources agencies have promoted and increasingly required more elaborate and habitat creating "biotechnical" construction techniques. It's still possible to obtain quotes within 20-30% of the \$1,000/lf "baseline" cost, but these are typically costs for "Traditional Construction" such as dumping rock rip-rap onto the bank with minimal customization or keyway trench excavation along the toe of the bank. Agencies resist permitting projects of this type, and promote "Biotechnical Construction" minimize use of rock material in favor of soil stabilized by biodegradable fabrics and densely packed live woody vegetation roots. Biotechnical projects must be more carefully designed and constructed in more detail to provide for the same resistance to bank slump failure as traditional projects – so the rock rip-rap materials cost savings can be completely given away to increased design and construction labor costs. Furnishing and installing live vegetation materials can cost more than rock-rip rap on a volume basis. Still, in general, if cost-effective design, permitting, and construction can be combined, biotechnical construction costs can be kept within 50% of the baseline cost:

- Traditional Construction (e.g., rip-rap blanket) minimum \$1,300 per lineal ft of bank
- Biotechnical Construction (e.g., partial rip-rap toe) minimum \$1,500 per lineal ft of bank

To achieve these minimum costs: (1) the project should be clearly designed to generate comparable construction bids and avoid expensive change orders during construction; (2) as many construction bids should be obtained as possible; (3) biotechnical specialist construction contractors should be invited to make bids; (4) design-build approaches such as having the project designer stake the construction site, field orient bidders, and field inspect and approve key project features can help to reduce the cost of design drawing production and avoid change orders.

(3) Estimated Construction Cost of the Left Bank Erosion Protection Project. The length of bank on Town of Ross property that needs erosion protection treatment is about 95 lineal feet. A minimum 5-ft-deep keyway trench is needed to accommodate current bed scour and deeper future scour after the creek bed is lowered by approx. 12-18 inches by the Unit 4 project when the fish ladder grade control structure is removed. A basic traditional bank erosion protection project (blanket the bank with rip-rap keyed down 5 ft below the bed) would cost at least about \$1,300/lineal ft or about \$125,000 to construct. A habitat-creating project that minimizes the use of rock and relies on fewer heavier, more carefully placed rocks and application of field-harvested live plant material intensive "biotechnical" techniques would cost at least about \$1,500/lineal ft or about \$145,000 to construct.

- Traditional Construction (e.g., rip-rap blanket) minimum \$125,000
- Biotechnical Construction (e.g., partial rip-rap toe) minimum \$145,000

(4) Treating Disturbed Bank and Top of Bank Area upstream from the Bridge. Recall that there was originally concern about bank erosion protection needs along the left bank upstream not downstream from the bridge. This was before the winter rainy season showed us precisely how the creek would respond to the new bridge opening. There remains a general need to improve bank toe erosion protection and establish appropriate vegetation on the disturbed bank area and within the 25-ft top of bank setback upstream from the bridge. At a minimum, this should be done to comply with the same Town codes and guidelines re. watercourse protection that residential projects are subject to. Last fall we amended the bridge project permits to include vegetation and erosion protection work at the upstream site and obtained a single cost estimate. The cost estimate was about \$24,000 but did not include several items that would have surfaced as change orders – \$35,000 is a more realistic estimate for the then proposed work there.

- *A different, somewhat less expensive, 100% biotechnical (no rock rip-rap) design is now applicable at the upstream treatment area. This cost is in addition to the minimum costs listed above for the Downstream Treatment Area.*

(5) Estimated Design, Permitting, Biological Monitoring, and Construction Supervision Costs for the Downstream Treatment Area. An RFP for design and permitting services would likely generate estimates ranging from \$55,000 to \$85,000. \$40,000 is a typical local industry minimum for a medium-sized erosion protection project. This project entails additional cost items because of design coordination required with Army Corps Hydraulic Division and County Flood Zone 9. It also requires dewatering, fish relocation, and biological monitoring during construction, and the so required coordination with NOAA Marine Fisheries. I estimated in email on or about February 11 that geomorphDESIGN could likely handle these services in house for less than about \$45,000. This includes the estimated \$8,000 preliminary quote received from Dr. Michael Fawcett to handle the dewatering, fish relocation, and biological monitoring during construction. To date, the permit applications (i.e., CEQA initial study and alternative analysis) and permit-level design drawings for both the Upstream and Downstream Treatment areas have been completed for \$16,250. Additional design drawing sheets and specifications will be necessary for sufficiently detailing bid package. A summary of estimated future costs through project completion is at the end of this memo.

(4) Separation of "Summer Work" and "Winter Work". In the permit application, the project has been proposed to treat both the upstream and downstream areas and separates the work into:

- "Summer Work" – work requiring creek dewatering and heavy equipment operation on the bed and top of bank areas; and,
- "Winter Work" -- mainly container and plug plant vegetation installation at both treatment areas and live willow brush matting and minor gully repair at the upstream treatment area.

Separating the work into two phases allows for comparable bids to be received for each phase – the best contractors for Summer Work are not the same as for Winter Work. And early winter is the best time to successfully install live willow material and most native CA riparian plantings.

- (5) Coordination with Army Corps of Engineers Hydraulic Division. This has essentially been completed. The proposed design in the permit application is a version of the general bank toe treatment that the Army Corps of Engineers has developed thus far for all of the design alternatives under current consideration. It is modified for creating best possible habitat according to the specific site conditions. My understanding is that the Army Corps of Engineers need not necessarily officially approve or disapprove of the proposed treatment because the Unit 4 Project is still in the design and environmental phase.
- (6) Coordination with County of Marin Flood Zone 9. This has essentially been completed. Jack Curley has indicated that the County doesn't have a problem with the project as proposed and is happy to see that it may be entirely consistent with the future Unit 4 Project so as not to need future reconstruction or modification. He said he would provide a letter to this effect if requested.
- (7) Environmental Permitting. The environmental permit applications have been completed and submitted. They are required to contain essentially what amounts to an Initial Study and Alternatives Analysis, and permit level design drawings. The actual bid package design drawings can differ slightly. Major revisions require submitting an addendum to the permit application.
- *I proposed project design I prepared and submitted on the Town's behalf is for biotechnical construction. This somewhat more expensive project: (1) coordinates best with preliminarily designed treatments at this bank section planned for the Army Corps Unit 4 project; (2) circumvents the alternatives analysis because it is the "environmental best" alternative; (3) creates an aesthetically superior result that may be more consistent with potential future park type improvements at the site; (4) provides a demonstration project for compliance with Town code and guidelines re. watercourse protection; etc.*
- (8) Preliminary Engineer's Cost Estimate. Based on the permit-level design drawings which have not been detailed to specific planting plan for "Winter Work" and do not include optional public access landscape improvements to be discussed:
- "Summer Work" (occurs at Downstream Treatment Area only) \$109,000
 - "Winter Work" (at upstream and downstream areas) \$48,000

The "Summer Work" engineer's estimate comes in at about \$1,150/lineal ft of bank. This is less than or the same as general estimates for traditional rip-rap blanket type bank stabilization. Obtaining bids as low as this will likely require either attaching much more detailed design drawings and specifications with the RFP package, or hosting a pre-bid field meeting to explain the drawings and

how they relate to field staked locations, and providing construction supervision at key junctures by the Project Designer.

See attachment for itemized estimates.

(9) Action Items. (To be described verbally at Public Works Committee meeting)

- (a) Discussion: Incorporate optional landscape elements for public access improvements into Summer Work? (Additional Design and Construction Cost)
- (b) Schedule field meeting with 29 SFD Blvd landowner re. this project and other outstanding subjects.
- (c) Develop consulting agreement with Dr. Michael Fawcett. His preliminary estimate based on his previous flawless work in 2009 job is that will take 45-55 hours at \$130 (\$6,250-7,950). He prefers working time and materials, or with a not-to-exceed-without-approval amount.
- (d) Strategy for obtaining construction bids for "Summer Work"

Recommendation:

- i. Finalize design drawings and specifications per internal review and incorporation of any options
- ii. Prepare RFP with design drawings and specifications attached
- iii. Host required pre-bid field meeting
- iv. Review bids and select contractor
- v. Construction supervision by Project Designer at minimum 3 key junctures

(e) Strategy for obtaining construction bids for "Winter Work"

Two ways to handle it:

- (i) Construction by Contractor -- Prepare complete planting plans and specifications for soliciting construction bids
- (ii) Construction by Town of Ross staff – time and materials assistance by landscape designer for plant selection, procurement, site guidance re. plant spacing, installation, etc.

(10) Summary of Estimated In House Design, Permitting, and Construction Management & Supervision Costs to Completion.

(see next page)

PROJECTED COSTS FOR DESIGN, PERMITTING, ENVIRONMENTAL MONITORING, AND CONSTRUCTION SUPERVISION
LEFT BANK EROSION PROTECTION PROJECT
 SUBTOTAL AND TOTALS DO NOT INCLUDE LANDSCAPE OPTIONS OR INSTALLATION BY TOWN OF ROSS

	<u>Completed</u>	<u>Projected</u>	<u>Projected Subtotal</u>
ENGINEERING, DESIGN, AND ENVIRONMENTAL SERVICES			
(a) Prepare permit-level design drawings and permit applications	\$ 16,250	\$ -	\$ 16,250
(b) Permit administration to issuance and finalize coordination with FZ9, COE, 29 SFD	\$ -	\$ 3,360	\$ 3,360
(c) Prepare final plans and specs for "Summer Work" (assumes minimum detail as per pre-bid mtg and field supervision approach)			
(i) <i>without optional public access improvements (landscape options)</i>	\$ -	\$ 4,520	\$ 4,520
<u>or</u>			
(ii) <i>with optional public access improvements (landscape options)</i>	\$ -	\$ 11,020	\$ 11,020
(d) Prepare planting plans for "Winter Work"			
(i) Plans and Specs for installation by bid selected Contractor	\$ -	\$ 5,500	\$ 5,500
<u>or</u>			
(ii) Time and materials assistance for installation by Town of Ross	\$ -	\$ 1,800	\$ 1,800
SUBTOTALS ENGINEERING, DESIGN, AND ENVIRONMENTAL SERVICES	\$ 16,250	\$ 13,380	\$ 29,630
CONSTRUCTION MANAGEMENT			
(e) Prepare and circulate RFP for "Summer Work"	\$ -	\$ 4,000	\$ 4,000
(f) Field stake "Summer Work" and host pre-bid meeting	\$ -	\$ 1,400	\$ 1,400
(g) Creek dewatering, fish relocation, environmental monitoring	\$ -	\$ 8,000	\$ 8,000
(h) Construction Supervision:"Summer Work" at 3 key junctures	\$ -	\$ 3,360	\$ 3,360
(i) Prepare and circulate RFP for "Winter Work"	\$ -	\$ 2,600	\$ 2,600
SUBTOTALS CONSTRUCTION MANAGEMENT	\$ -	\$ 19,360	\$ 19,360
GRAND TOTAL ENGINEERING & ENVIRONMENTAL, AND CONSTRUCTION MANAGEMENT	\$ 16,250	\$ 32,740	\$ 48,990

ENGINEER'S FIRST ESTIMATED CONSTRUCTION QUANTITIES

LEFT BANK EROSION PROTECTION PROJECT, TOWN OF ROSS

* Estimate assumes & equivalents of "Traffic Control Stone (TCS)" Structures per Permit-Level Design Submitted with permit applications

1	D/S	SITE PREPARATION	LS	1	\$	500	\$	500	EST	3-5 TREES AT EDGE OF SETBACK AREA
2	D/S	CLEAR AND GRUB DOWNSTREAM TREATMENT AREA	LS	1	\$	1,800	\$	1,800	EST	(3,500 SQ FT) SCRAPE OFF INVASIVE PLANTS WITH ROOTS; INCLUDES 2-3 LIGHTWEIGHT TREES
3	D/S	OFF-HAUL GRUBBED VEGETATION	CY	60	\$	1,200		1,200	EST	DISPOSE TO APPROVED LANDFILL FOR COMPOSTING REUSE
4	D/S	EXCAVATE TOE TRENCH	CY	90	\$	100	\$	9,000	RVMP	TRENCH IS DEEPER WITHIN TCS FOOTING AREAS; SPREAD STOCKPILE
5	D/S	EXCAVATE & STOCKPILE	TONS	80	\$	440	\$	35,200	HARRIS	TAN-COLORED ROCK HAND SELECTED FOR STACKING
6	D/S	FURNISH & PLACE	LS	5	\$	2,000	\$	10,000	EST	ASSUME 5 LARGE LOG-ROOTWADS AND 10 EPOXY AND GALV WIRE ROPE CABLE ANCHORS TO ROCK
7	D/S	LOG-ROOTWADS ANCHORED INTO STRUCTURES	TONS	5	\$	250	\$	1,250	EST	BURIED BEHIND LAGGING AND WITHIN BRUSH LAYERING
8	D/S	3/4-TON RIP-RAP	TONS	5	\$	250	\$	1,250	EST	BURIED BEHIND LAGGING AND WITHIN BRUSH LAYERING
9	D/S	LIGHT CLASS RIP-RAP	TONS	5	\$	250	\$	1,250	EST	BURIED BEHIND LAGGING AND WITHIN BRUSH LAYERING
10	D/S	12-FT-LONG 6-IN X 6-IN MIN PLANK LAGGING	PIECES	60	\$	40	\$	2,400	GWRY	LAGGING BEHIND AND ABOVE TCS STRUCTURES; RECYCLED TREE SOURCED (PREF. DEODAR CEDAR)
11	D/S	FILTER FABRIC	SF	1,100	\$	1.25	\$	1,375	EST	BEHIND AND OVER LAGGING
12	D/S	NATIVE BACKFILL	CY	20	\$	75	\$	1,500	EST	BEHIND AND OVER FILTER FABRIC - PUSH DOWN FROM UPPER BANK EXCAVATION
13	D/S	EXCAVATE UPPER BANK TO 1.5:1H MAX (VAR.)	CY	20	\$	75	\$	1,500	RVMP	OVERBALL PROJECT RESULTS IN MINOR NET CUT & NET FILL WITHIN TOP OF BANK SETBACK AREA
14	D/S	SPREAD & GRADE NATIVE SANDY GRAVEL	CY	30	\$	75	\$	2,250	RVMP	SPREAD AND MODERATELY COMPACT MINOR NET FILL WITHIN TOP OF BANK SETBACK AREA
15	D/S	LIVE WILLOW BRUSH LAYERING	SF	300	\$	55	\$	16,500	RVMP	WITH BIODEGRADABLE FABRIC; WRAPPED SOIL LIFTS
16	D/S	TRIPLE-LAYER BIODEGRADABLE FABRIC	SF	900	\$	5	\$	4,500	HARRIS	TRIPLE-LAYER FASTENED ONTO UPPER BANK SURFACE AND KEYS PER DETAILS
17	D/S	PLACE GEFABRIC	LS	1	\$	6,000	\$	6,000	EST	LARGE EXCAVATOR VIA PARKING LOT AND TRAFFIC CONTROL
18	D/S	MOB & DEMOB	LS	1	\$	1,000	\$	1,000	EST	FOR DELIVERING ROCK END-DUMPS OFF OF LAGUNITAS ROAD
19	D/S	TRAFFIC CONTROL	LS	1	\$	1,000	\$	1,000	EST	TO BE DONE BY OTHERS (TOWN OF ROSS OR CONTRACTORS IN SUMMER)
20	D/S	10% CONTINGENCY	SF	300	\$	7.00	\$	2,100	EST	TO BE DONE BY OTHERS (TOWN OF ROSS OR CONTRACTORS IN SUMMER)
21	D/S	TEMPORARY IRRIGATION	SF	300	\$	7.00	\$	2,100	EST	TO BE DONE BY OTHERS (TOWN OF ROSS OR CONTRACTORS IN SUMMER)
										SUBTOTAL SUMMER EARTHWORK AND EROSION CONTROL AT DOWNSTREAM AREA: \$ 109,048
22	D/S	VEGETATE UPPER BANK AND TOP OF BANK SETBACK	SF	3,000	\$	8.50	\$	25,500	HARRIS	TO BE DONE BY OTHERS (TBD CONTRACTORS IN EARLY WINTER)
23	U/S	LIVE WILLOW BRUSH MATRESS ALONG TOE OF BANK	SF	270	\$	35	\$	9,450	RVMP	TO BE DONE BY OTHERS (TBD CONTRACTORS IN EARLY WINTER)
24	U/S	VEGETATE UPPER BANK AND TOP OF BANK SETBACK	SF	1,400	\$	8.50	\$	11,900	HARRIS	TO BE DONE BY OTHERS (TBD CONTRACTORS IN EARLY WINTER)
25	U/S	REPAIR AND PLANT GULLY	LS	1	\$	1,500	\$	1,500	EST	TO BE DONE BY OTHERS (TBD CONTRACTORS IN EARLY WINTER)
										SUBTOTAL WINTER WORK: \$ 48,350
										GRAND TOTAL CONSTRUCTION \$ 157,398

DOES NOT INCLUDE OPTIONAL LANDSCAPE FEATURES FOR PUBLIC ACCESS AT DOWNSTREAM AREA

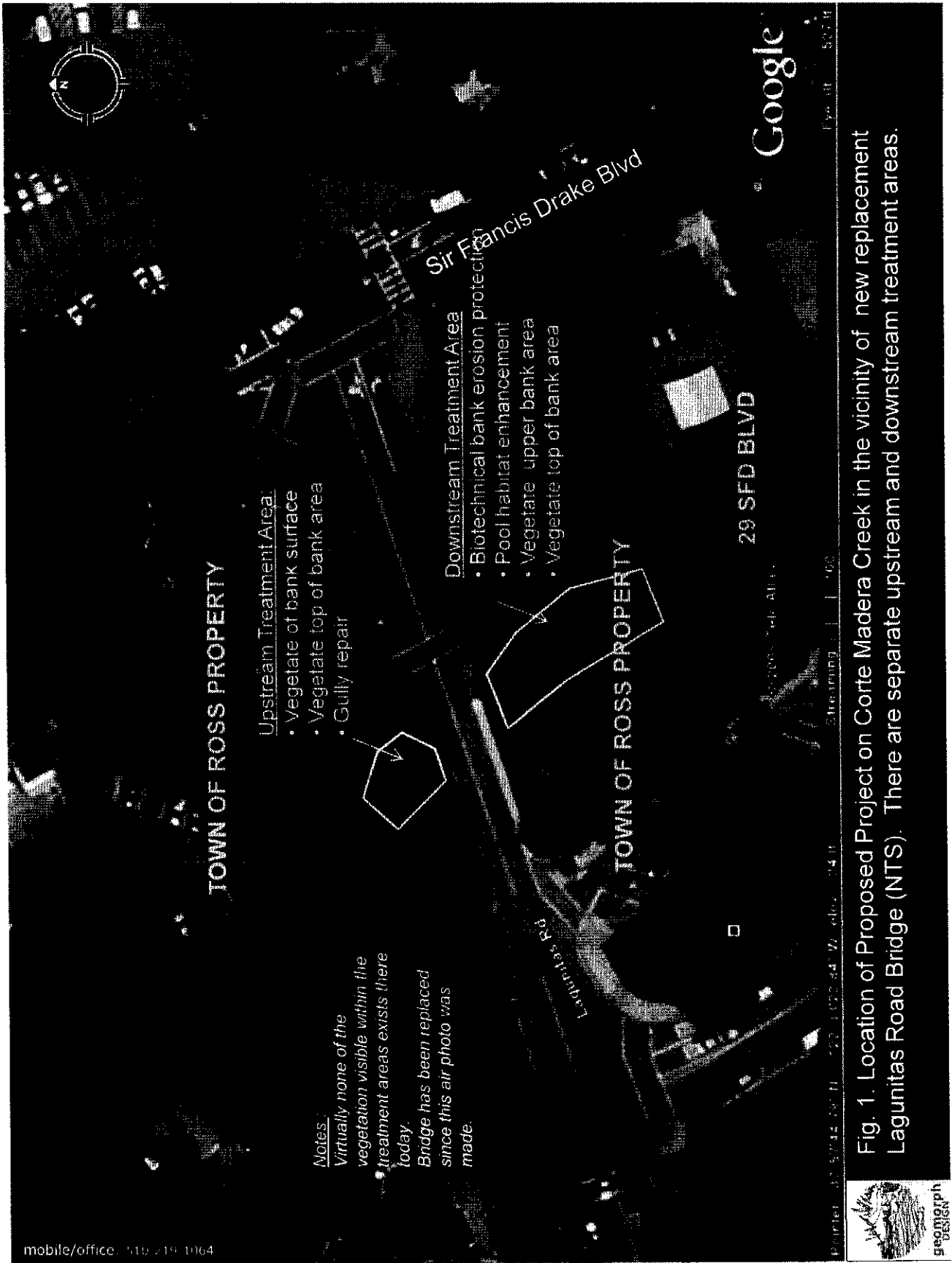


Fig. 1. Location of Proposed Project on Corte Madera Creek in the vicinity of new replacement Lagunitas Road Bridge (NTS). There are separate upstream and downstream treatment areas.



WINTER WORK AT UPSTREAM TREATMENT AREA

**specific planting plan to be developed*

25-FT TOP OF BANK
SETBACK AREA

*This non-native
vegetation has
been removed*

REPAIR
GULLY

EXISTING GROUND SURFACE



Fig. 4. Upstream Bank Area OBJECTIVES: (1) establish drought-tolerant CA native riparian woodland plants on entire biodegradable fabric covered bank surface; (2) repair gully with keyed biodegradable fabric and woody plantings including live willow material.

EXISTING CONDITIONS

CREEK IS TRYING TO
ESTABLISH AN OUTSIDE
BEND SCOUR POOL IN
THIS SECTION -
PROPOSED PROJECT
WOULD ACCOMMODATE
THAT PROCESS

Fig. 5a. Downstream Bank Area (Upstream Section) EXISTING CONDITIONS: several minor active bank toe slumps; invasive-exotic vegetation; lack of canopy cover, near-shore vegetation, and woody debris cover at edge of water; etc. (Photo: March 11, 2011)



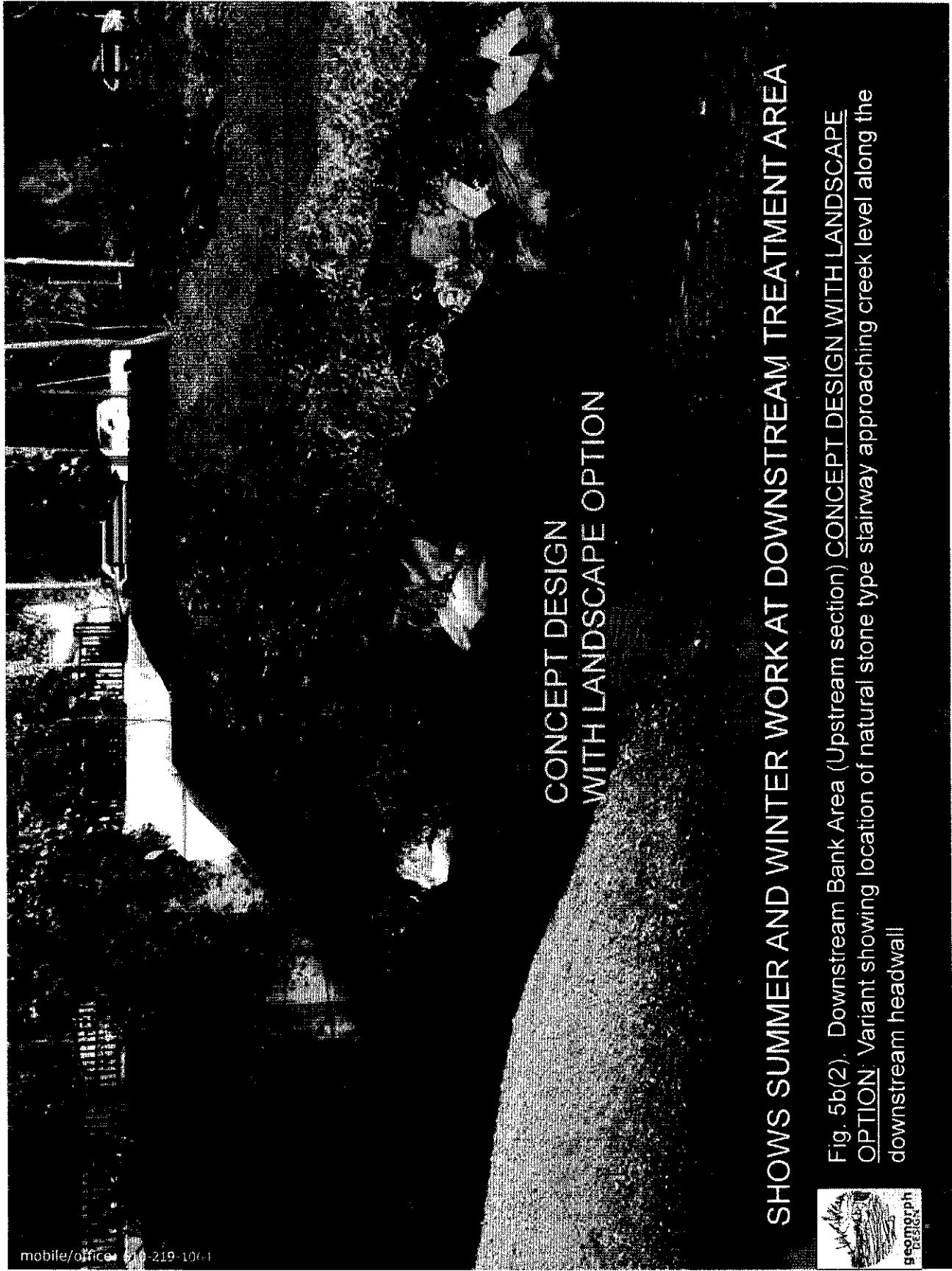
CONCEPT DESIGN *specification planting plan to be provided as addendum*



SHOWS SUMMER AND WINTER WORK AT DOWNSTREAM TREATMENT AREA



Fig. 5b. Downstream Bank Area (Upstream section) CONCEPT DESIGN: (1) slot-trenched live willow pole vegetated "Diamond Traffic Control Stone" bendway weir structures on 10-ft centers along toe of bank; (2) recycled redwood log-rootwads; (3) live willow brush layering and matting at mid-bank; (4) biodegradable fabric-covered and vegetated upper bank and top of bank setback area.



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SHOWS SUMMER AND WINTER WORK AT DOWNSTREAM TREATMENT AREA

CONCEPT DESIGN WITH LANDSCAPE OPTION



Fig. 5b(2). Downstream Bank Area (Upstream section) CONCEPT DESIGN WITH LANDSCAPE OPTION: Variant showing location of natural stone type stairway approaching creek level along the downstream headwall

EXISTING CONDITIONS

CREEK IS TRYING TO
ESTABLISH AN OUTSIDE
BEND SCOUR POOL IN
THIS SECTION -
PROPOSED PROJECT
WOULD ACCOMMODATE
THAT PROCESS.

Fig. 5c. Downstream Bank Area (Downstream Section) EXISTING CONDITIONS: several minor active bank toe slumps; invasive-exotic vegetation; lack of canopy cover, near-shore vegetation, and woody debris cover at edge of water, etc. Downstream project limits at approx. property boundary shown (Photo: March 11, 2011)



CONCEPT DESIGN

SHOWS SUMMER AND WINTER WORK
AT DOWNSTREAM TREATMENT AREA

Fig. 5d. Downstream Bank Area (Downstream Section) CONCEPT DESIGN: (1) slot-trenched live willow pole vegetated "Diamond Traffic Control Stone" bendway weir structures on 10-ft centers along toe of bank; (2) recycled redwood log-rootwads; (3) live willow brush layering and matting at mid-bank; (4) biodegradable fabric-covered and vegetated upper bank and top of bank setback area.

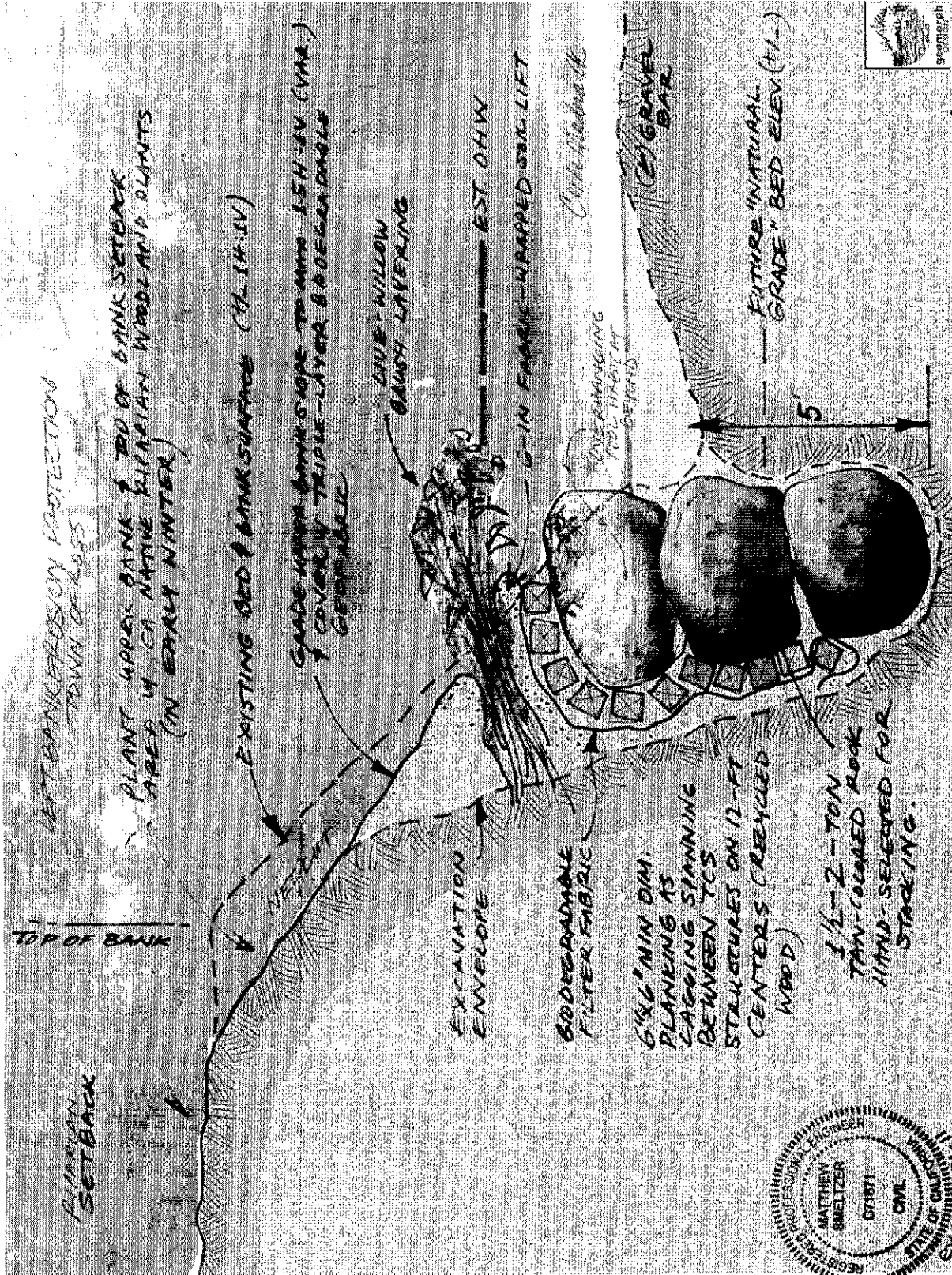


CONCEPT DESIGN WITH LANDSCAPE OPTION

SHOWS SUMMER AND WINTER WORK
AT DOWNSTREAM TREATMENT AREA

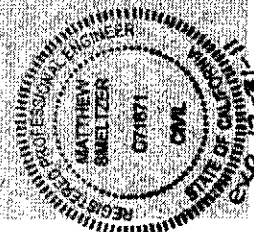
Fig. 5e. Downstream Bank Area (Downstream Section) CONCEPT DESIGN WITH LANDSCAPE OPTION: Variant showing decomposed granite and wood mulch pedestrian trail looping down onto the mid-bank area to improve public access and enjoyment of the creek.





SCALE: 1"=2' (1-1) 4711

SECTION (TYP)



ADAPTATION OF DERRICK'S TRAFFIC CONTROL STONE BANK TOE EROSION PROTECTION STRUCTURES FOR UNIT 4 FLOOD CONTROL CHANNEL NATURAL GRADE



(N) TRIPLE-LAYER GEOTEXTILE COVERED (5H: 1V MAX SLOPED (VAR.)) UPPER BANK

(E) TOP OF BANK

12' O.C.

(S) RED TOE

EST. NATURAL GRADE

1/2-2-TON ROCK - TAN COLORED - HAND SELECTED FOR STACKING

TO BE EVENLY

SCALE: 1"=2'

PROFILE ELEVATION (TYP.)

