

MEMORANDUM

TO: Town of Ross Public Works Committee
FROM: Matt Smeltzer
DATE: April 29, 2011
SUBJECT: Implementing Bolinas Avenue Drainage Improvements

- (1) January 25, 2011 Report. The planning-level hydrology and hydraulics study estimated peak stormwater flows and evaluated a range of potential measures for reducing peak flows tributary to Upper Bolinas Avenue (i.e., between Kensington and Richmond Aves) and Lower Bolinas Avenue (i.e., between Richmond Ave and Corte Madera Creek outfall). Measures evaluated included:
- (a) Replacing high-maintenance and failing culverts and inlets and adding new culverts at seven locations along Oak Avenue in San Anselmo (Measure 1);
 - (b) Implementing on-site detention storage on multiple properties (Measure 6);
 - (c) Diverting stormwater into an improved "Fernhill Creek" drainage system (Measure 5);
 - (d) Upgrading the existing Lower Bolinas Avenue concrete box culvert on the San Anselmo side (Measure 2); and
 - (e) Installing a new large diameter culvert system running under the Ross side of Bolinas Avenue outfalling to either Ross Creek near the rear of 1 Shanley Lane (Measure 3) or Corte Madera Creek at Sir Francis Drake Blvd bridge (Measure 4).

➤ *Please see attached location map of these and other measures evaluated.*

Key findings of the H&H study included:

- (i) New and improved culverts/inlets along Oak Ave in San Anselmo would substantially reduce peak flows discharged onto Upper and Lower Bolinas Avenue (and in turn *increase* peak flows conveyed correctly to the subject drainage systems in San Anselmo);
- (ii) Installing site-scale detention on multiple properties is not a cost effective measure for reducing peak flows onto Bolinas enough to substantially reduce the frequency of either sidewalk overflows along Upper Bolinas Ave or ponding near the Richmond-Bolinas intersection;
- (iii) Large centralized detention facilities (i.e., subsurface vaults) are more cost effective and should at a minimum be considered as a measure to mitigate for (i.e., neutralize) increases to Corte Madera Creek peak flow caused by improving Bolinas Ave drainage;
- (iv) Upgrading the existing concrete box culvert system on the San Anselmo side is neither cost nor hydraulically effective because the system is laid out on a flat slope and subject to potential future

increased tailwater elevations on Corte Madera Creek should the Ross Valley Flood Reduction and Creek Management Master Plan be implemented to reduce floodplain flows in San Anselmo;

- (v) The most cost effective measure for reliably reducing frequent ponding of stormwater in the Bolinas-Richmond intersection vicinity is to install a new 42- to 48-in-diam 0.7-0.8-percent-sloped reinforced concrete pipe culvert originating near the intersection and running under the Ross side of the street (Measure 3 or 4);
- (vi) Outfalling to Ross Creek (Measure 3) was found to be potentially more cost effective and possibly realizing additional benefits of improving drainage for the "Fernhill Creek" drainage system, but easements and private property owner cooperation would be required. Alternatively, outfalling to Corte Madera Creek near SFD Blvd Bridge (Measure 4) requires a significantly longer, deeper run of culvert, but it can be constructed entirely or virtually entirely within the public right-of-way;
- (vii) A large centralized detention facility would be necessary to mitigate for eliminating the detention effect of the stormwater pond frequently formed at the Bolinas-Richmond intersection. The actual required minimum design volume of the detention facility would depend on detailed hydraulic design calculations, but the high end can be approximated by the existing surface pond volume (approx. 150,000-200,000 gallons).

(2) February 10, 2011 Council Action. The January 25, 2011 report was synthesized and presented to the Town Council on February 10, 2011, including new information generated by response and follow-up to the report. Specifically, easement research and feedback from private property owners gathered earlier that week indicated lack of support for Measure 3, and general lack of support for measures that would alter "Fernhill Ck" drainage in whole or in part. The presentation concluded by recommending a concise list of measures and planning-level cost estimates be considered further for refinement and potential implementation:

Measure 1 – Culvert improvements Oak Ave in San Anselmo	\$300,000
Measure 4 – New 1,320-ft-long 0.8%-sloped 48-in-diam culvert to CM Ck	\$780,000
Measure 4 Bioretention – Surface landscaping within ROW along Parking Lot	\$220,000
Measure 8b Detention Vault – Subsurface up to 200,000 gallons	<u>\$650,000*</u>
Total	\$1,950,000

* cost estimate based on typical recent pre-fabricated modular reinforced concrete vaults installed by WA DOT in Seattle

The Town Council approved a motion to proceed with further analysis and evaluation of these measures.

(3) Information Gathering Since February 10, 2011.

- (a) *Install flapgate at Winship Ave Bridge.* The February 10, 2011 recommended and Council approved measures should have included Measure 2j – Install flapgate at existing drainage system outfall at Winship Ave Bridge to prevent backflow during high Corte Madera Creek flows (\$11,000).
- (b) *Potential grant fund sources.* There remains a question as to whether or not grant funding might be available for the drainage improvements, e.g., in as much as the project may protect stormwater

quality by reducing inundation of residential garages containing toxic chemicals and/or chemicals adsorbed to particles trapped in the typical front end filtration chamber of a subsurface detention vault. [ACTION ITEM: NEED TO CONTACT TERRI FASHING, ETC., AND REPORT SOMETHING HERE]

(c) *First phase project scope cost minimization.*

(i.) *Eliminate Measure 1.* Measure 1 would occur outside of the actual Bolinas Ave watershed proper. The work entailed involves several small-scale fundamental maintenance projects which should be pursued by the City of San Anselmo as part of its normal stormwater system maintenance program. Eliminating Measure 1 from the Phase 1 project would keep its footprint in the vicinity of the immediate problem to solve – eliminating frequent ponding at the Richmond-Bolinas intersection. To some extent, the benefits of Measure 1 can be achieved by repeat manual maintenance during individual storms by Town and City staff.

(ii.) *Separation of upstream and downstream Bolinas Avenue drainage improvements.* Eliminating Measure 1 also eliminates peak flow reductions sought on Upper Bolinas Avenue for reducing inundation and overflow of the Ross side gutter and sidewalk and stormwater bypass onto Ross side private properties below the street.

(iii.) *Alternatives to reinforced concrete detention vaults.* Phiroze Wadia was involved with the implementation of a comparably sized detention vault constructed using plastic cellular matrix materials capped with 2-3-ft of cover under the Redwood High School parking lot in Larkspur. The Redwood High School example was approx. 6-ft-deep, 150-ft-wide, and 200-ft-long. At the manufacturer stated 94% void ratio, the example vault stores approx. 1.25 million gallons – about 6 times larger than the preliminary estimated mitigation target for the Bolinas Ave project. [ACTION ITEM: COORDINATE WITH PHIROZE TO OBTAIN THE DESIGNER CONTACTS AND TRACK DOWN CONSTRUCTION COSTS, ETC.]

➤ *Please see attached figure indicating footprint of the Redwood High School detention vault overlaid on a sketch depicting one potential traffic calming strategy at the Richmond-Bolinas intersection area. This is a potential configuration of Measure 8b.*

(iv.) *Forego Measure 4 Bioretention as an optional overlay pending outcome of basic civil design.* Measure 4 Bioretention is not critical to either the hydraulics or environmental mitigation of the drainage improvements. Furthermore, the extent to which Measure 4 construction might disrupt the right of way requiring its landscape be totally reconstructed, as would create opportunity for bioretention-functioning landscape, depends in part on civil design to be determined as well as Town landscape preferences at the corner of Bolinas Ave and Sir Francis Drake Blvd (i.e., northeast corner of the Town limits). Measure 4 Bioretention could be constructed in later phase.

(4) Engineer's Preferred Alternative. The following measures and planning-level cost estimates are recommended as a refined minimum scope Phase 1 Project based on present information. Planning-level costs are subject to revision during design development phase. The detention vault cost is also subject to revision according to site location and structural type selected or tbd:

"Phase 1 Bolinas Ave Drainage Improvement Project"

Measure 4 – New 1,320-ft-long 0.8%-sloped 48-in-diam culvert to CM Ck	\$780,000
Measure 2j – New flapgate on existing culvert outfall at Winship Ave Bridge	\$11,000
Measure 8b or 8c – 200,000 gal min vault at either location	<u>\$650,000*</u>
Total	\$1,441,000

* or tbd cost for subsurface cellular plastic matrix vault alternative

- (5) Consistency with traffic calming and street resurfacing plans. The recommended “Phase 1 Bolinas Ave Drainage Improvement Project” should be consistent as far as feasible with planned but not designed traffic calming and roadway resurfacing work on Bolinas Avenue. First, physically – to avoid design conflicts or problematic reconstruction, etc. And second, administratively – combining the drainage improvement project with the larger streetscape revitalization project might activate the \$250,000 TAM grant before it expires. [ACTION ITEM: DETERMINE JUST HOW SO, WHY, BY WHEN, ETC.]

Currently there is no specific adopted design information for the planned traffic calming and street resurfacing project(s). Absent any guidance, Measure 4 would likely be designed to run the new 48-inch reinforced concrete culvert directly beneath the Ross side gutter of Bolinas Avenue, then turning south to Corte Madera Creek either (a) under the existing gutter line of Sir Francis Drake Blvd or (b) under the Town of Ross right-of-way running between SFD Blvd and the St. Anselm parking lot. Measure 4 would include installation of new probably standard single or multiple grouped 2-ft by 2.5-ft catch basins (with combination curb inlets) at several locations along the Ross side gutter line. If the future traffic calming and street resurfacing design were to include modifications to the curb-and-gutter alignment or profile, such as “bulb-outs”, then the new catch basins/inlets may need to be relocated or modified.

- *The drainage improvement project design would benefit greatly from a 30% traffic calming and street resurfacing project design.*

Measure 8 (detention vault) is an entirely below grade facility that can be located under any open paved or open natural space within or directly adjacent to Bolinas Ave right of way. Measure 8b (detention vault located under Richmond Avenue immediately north of the Richmond-Bolinas intersection) is recommended because the vault can be located under an existing extremely oversized open paved area that will likely be modified for traffic calming purposes. This location also allows gravity drainage of Upper Bolinas Ave curb flows into the vault and partial (mid-level) gravity drainage of the vault storage to the new Measure 4 culvert system (minimized pumping requirements). Furthermore, the site provides a “capacitor” effect where the new Measure 4 system is most strongly controlled by inlet capacity owing to the adverse grade of Lower Bolinas Avenue. (Note that the attached figure also demonstrates the considerable streetscape improvement the space affords by augmenting the neighborhood and regional amenity provided by the beautiful Montgomery Chapel.)

- *Also note that the Measure 8b vault location is within San Anselmo not Ross.*

The H&H Study also evaluated locating subsurface detention vaults on the Seminary Property near the Bolinas-Kensington intersection under the Redwood Glade (Measure 8a), and near the Bolinas Ave-SFD Blvd intersection under the St. Anselm Church overflow parking lot (Measure 8c). Measure 8a would have least capacity, as may be limited by concerns of effects on redwood tree roots.

Measure 8c would have comparable capacity, but pumping from a stilling basin may be required to fill the relatively shallow vault from the relatively deep run of Measure 4 culvert at that location.

(6) Phase 1 Bolinas Ave Drainage Improvement Project Scoping

(a) *Title.* We recommend that "Phase 1 Bolinas Ave Drainage Improvement" be a secondary project title to or under a title tbd for the broader traffic calming and street resurfacing or streetscape revitalization project. [ACTION ITEM: DEVELOP TITLE AND PHASING PLAN FOR UPPER AND LOWER BOLINAS AVENUE STREETScape AND DRAINAGE IMPROVEMENTS]

(b) *CEQA issues.*

- (i.) *Effects on Corte Madera Creek peak flow.* To be mitigated using hydraulically designed subsurface detention vault. [ACTION ITEM: CHECK ON STATUS OF SIMILAR PERMIT APPLICATION IN TOWN OF FAIRFAX]
- (ii.) *Effects on Corte Madera Creek habitat at the outfall location.* To be mitigated by biotechnical bank stabilization surrounding the outfall and a rock-and-large-woody debris energy dissipation structure on the bed beneath the outfall that provides permanent woody cover at the existing channel bend scour pool downstream from the SFD Blvd bridge. [ACTION ITEM: CHECK ON STATUS OF SIMILAR PERMIT APPLICATION IN TOWN OF FAIRFAX]
- (iii.) *Effects on private properties.* There may be private property at the downstream end of the Measure 4 culvert line between the Town right of way and the creek bank, or including the creek bank. [ACTION ITEM: DETERMINE PROPERTY OWNERSHIP WITHIN THE PROJECT FOOTPRINT.]

➤ *Please see attached map showing the planning level proposed Measure 4 culvert alignment.*

(iv.) *Other*

(c) *Design Services.*

Please see contracting strategy below.

(7) Contracting Strategy.

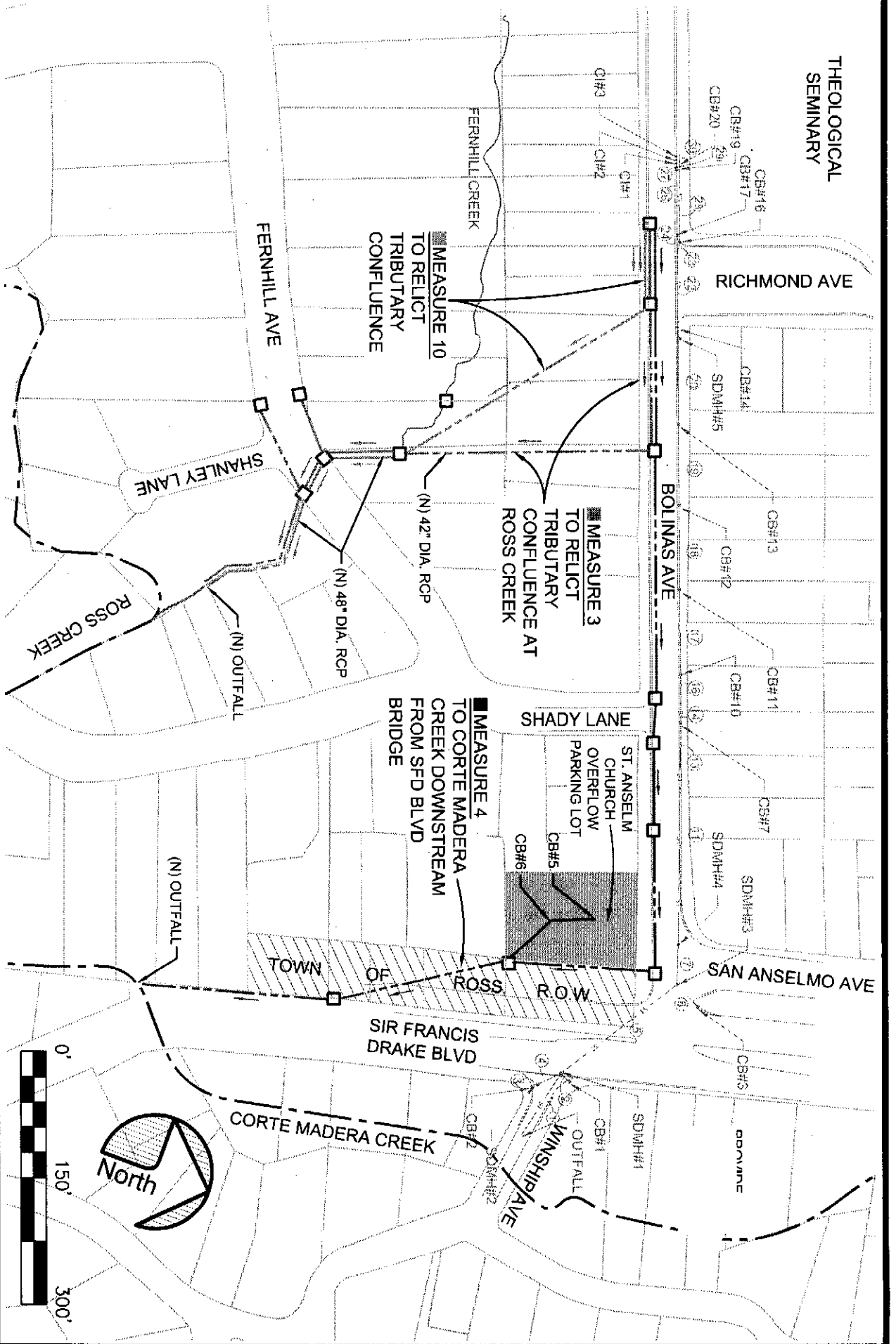
(a) *Environmental Permitting*

- Single permit for larger project?
- Separate permits for drainage and streetscape improvements, phases?
-

(b) *Surveying*

- Basemap for larger project and drainage improvements
 - Civil design basis for drainage improvements
 - Street and sidewalk (i.e., basemap for larger streetscape project)
 - Existing stormwater facilities, including internal inspection and invert elevation surveys
 - Right of way boundaries
 - Private property boundaries
 - Utilities, Underground Service Alert
 - Creek bed and bank topography in vicinity of SFD Blvd Bridge outfall, including the downstream face of the bridge outside bend pool downstream from the bridge
 -
- (c) *Traffic Calming and Street Repaving*
- 30% Design for Consistency with Phase 1 Drainage Improvements
 - Public Workshop for Larger Project?
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- (d) *Hydrology and Hydraulics*
- January 25, 2011 H&H report may suffice for sizing Measure 4 system
 - Measure 8b hydraulic design analysis needed to substantiate mitigation and performance, operations and maintenance, etc.
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- (e) *Civil Design Measure 4*
- Experienced with stormwater culvert drainage network design and construction
 -
- (f) *Civil Design Measure 2j*
- Minor (in house?)
 -
- (g) *Civil Design Measure 8b or 8c*
- Experienced with detention vault and basin design
 -

THEOLOGICAL SEMINARY



**BOLINAS AVE STORMWATER ANALYSIS
STORM DRAIN NETWORK SCHEMATIC
POTENTIAL IMPROVEMENT MEASURES
FOR LOWER BOLINAS AVENUE**

LEGEND

	MEASURE 3 CULVERT / PIPE
	MEASURE 4 CULVERT / PIPE
	MEASURE 10 CULVERT / PIPE
	NEW CATCH BASIN

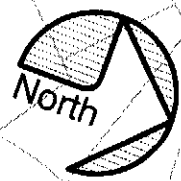
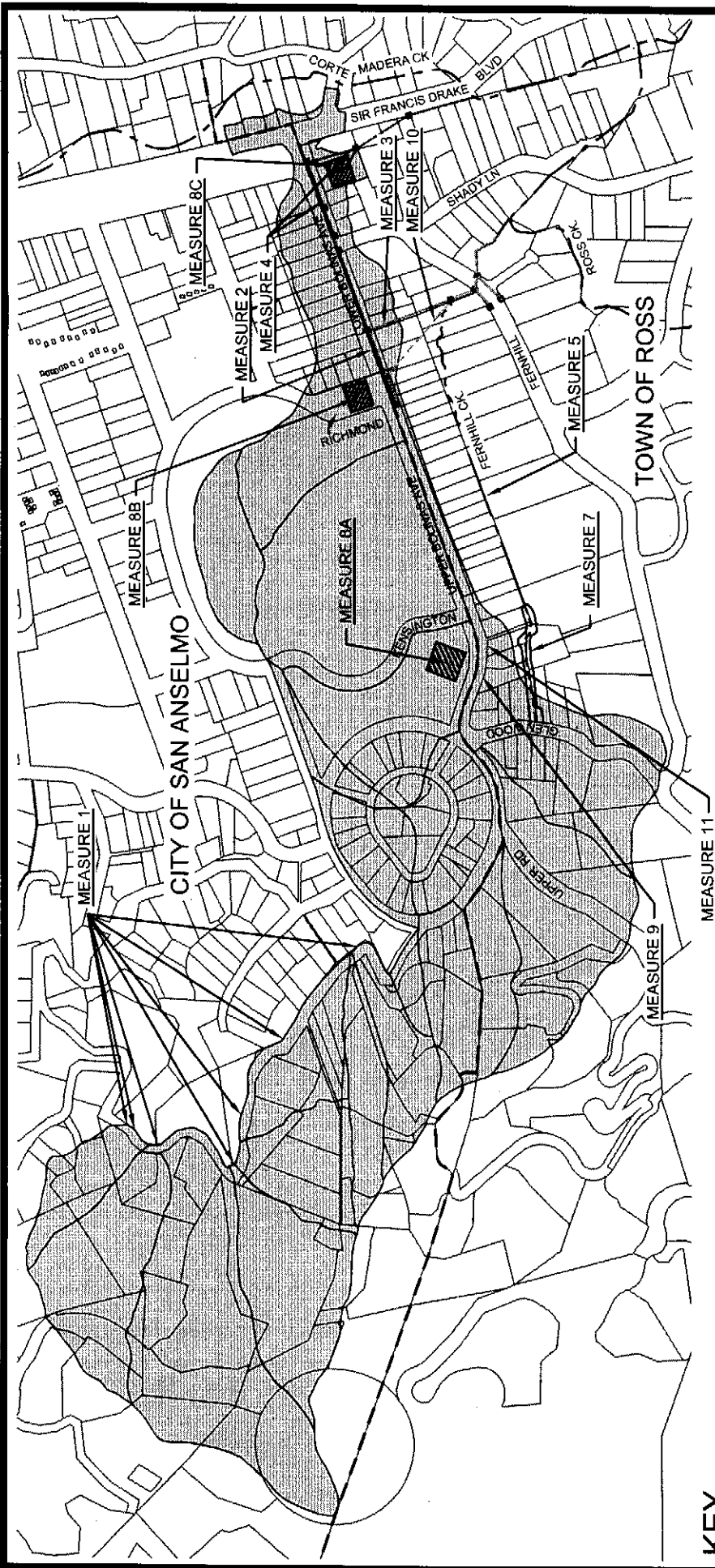


FIGURE 2

JAN 25, 2011



KEY

- MEASURE 1: NEW OR REPLACEMENT CULVERT CROSSINGS AT 7 SITES ALONG UPPER OAK AVENUE
- MEASURE 2: IMPROVE UPSTREAM SECTION OF EXISTING CONCRETE BOX CULVERT NETWORK
- MEASURE 3: NEW 42-INCH-DIAM CULVERT FROM RICHMOND INTERSECTION TO ROSS CREEK
- MEASURE 4: NEW 42-INCH-DIAM CULVERT FROM RICHMOND INTERSECTION TO CORTE MADERA CREEK
- MEASURE 5: IMPROVE FERNHILL CREEK DRAINAGE AND ELIMINATE SUMP PUMPAGE ONTO BOLINAS AVE
- MEASURE 6: REDUCE STORMWATER PEAK FLOWS WITH ON-SITE DETENTION FACILITIES ON INDIVIDUAL PARCELS
- MEASURE 7: DIVERT STORMWATER FLOWS FROM GLENWOOD AVE INTO MEASURE 5 IMPROVED FERNHILL CREEK
- MEASURE 8A: LARGE SUBSURFACE STORMWATER DETENTION VAULT AT SEMINARY PROPERTY
- MEASURE 8B: LARGE SUBSURFACE STORMWATER DETENTION VAULT UNDER RICHMOND AVE RIGHT-OF-WAY
- MEASURE 8C: LARGE SUBSURFACE STORMWATER DETENTION VAULT AT ST. ANSELMO CHURCH OVERFLOW PARKING LOT
- MEASURE 9: NEW 42-INCH-DIAM CULVERT NETWORK FROM GLENWOOD TO RICHMOND
- MEASURE 10: NEW 42-INCH-DIAM CULVERT FROM RICHMOND INTERSECTION TO ROSS CREEK (ALTERNATIVE ROUTE)
- MEASURE 11: RECONTOUR UPPER BOLINAS AVE TO INCREASE STREET STORMWATER FLOW CAPACITY

**BOLINAS AVE STORMWATER ANALYSIS
LOCATION MAP
POTENTIAL IMPROVEMENT MEASURES
UPPER AND LOWER BOLINAS AVE.**



FIGURE 4
JAN 25, 2011

PRIMER: SUBSURFACE STORMWATER DETENTION VAULTS

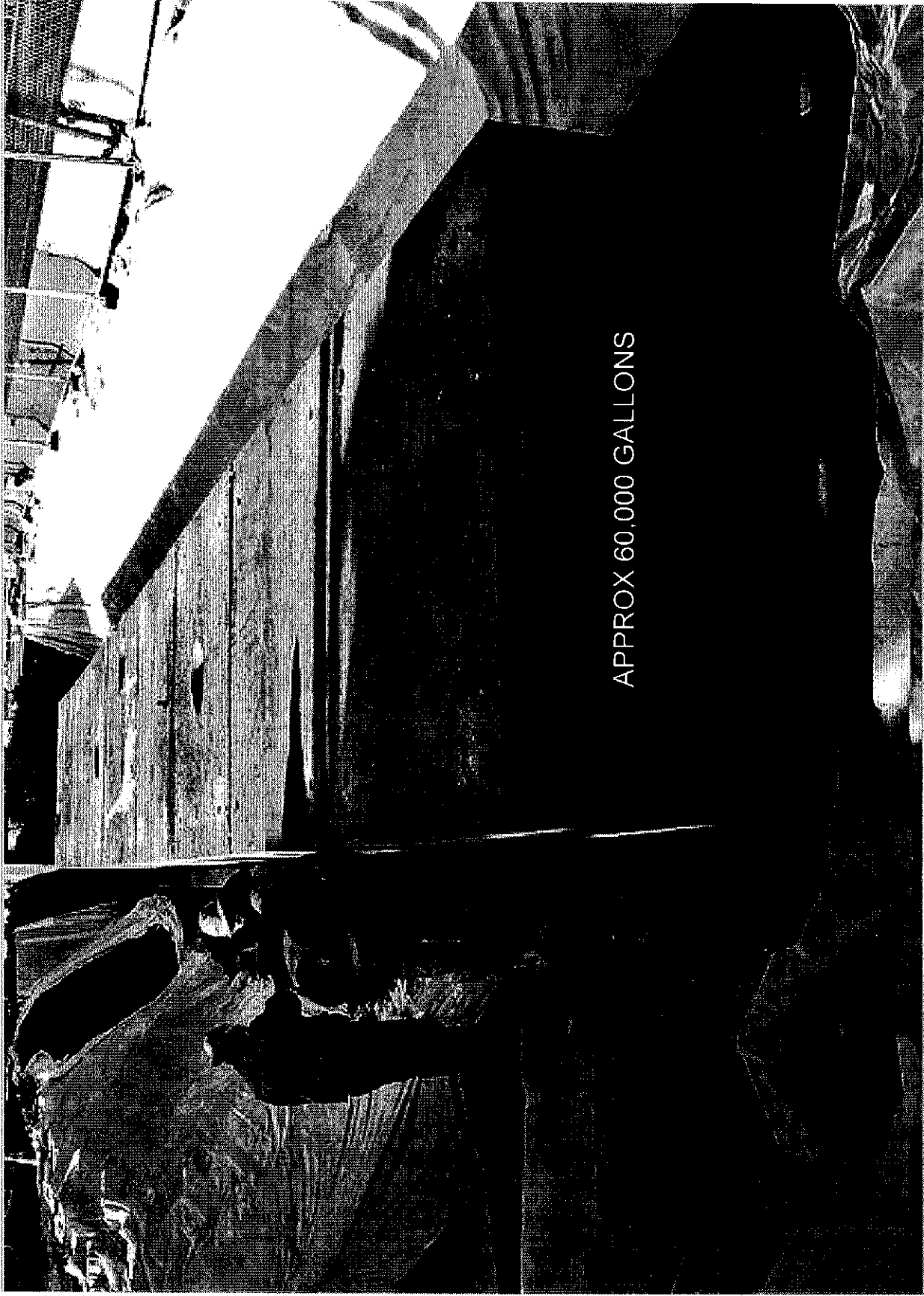
• PRE-FAB REINFORCED CONCRETE

- 100% VOID RATIO
- TALLER FOR SMALLER FOOTPRINTS
- HEAVIER LOADS
- GENERALLY MORE EXPENSIVE

• PLASTIC CELLULAR MATRIX

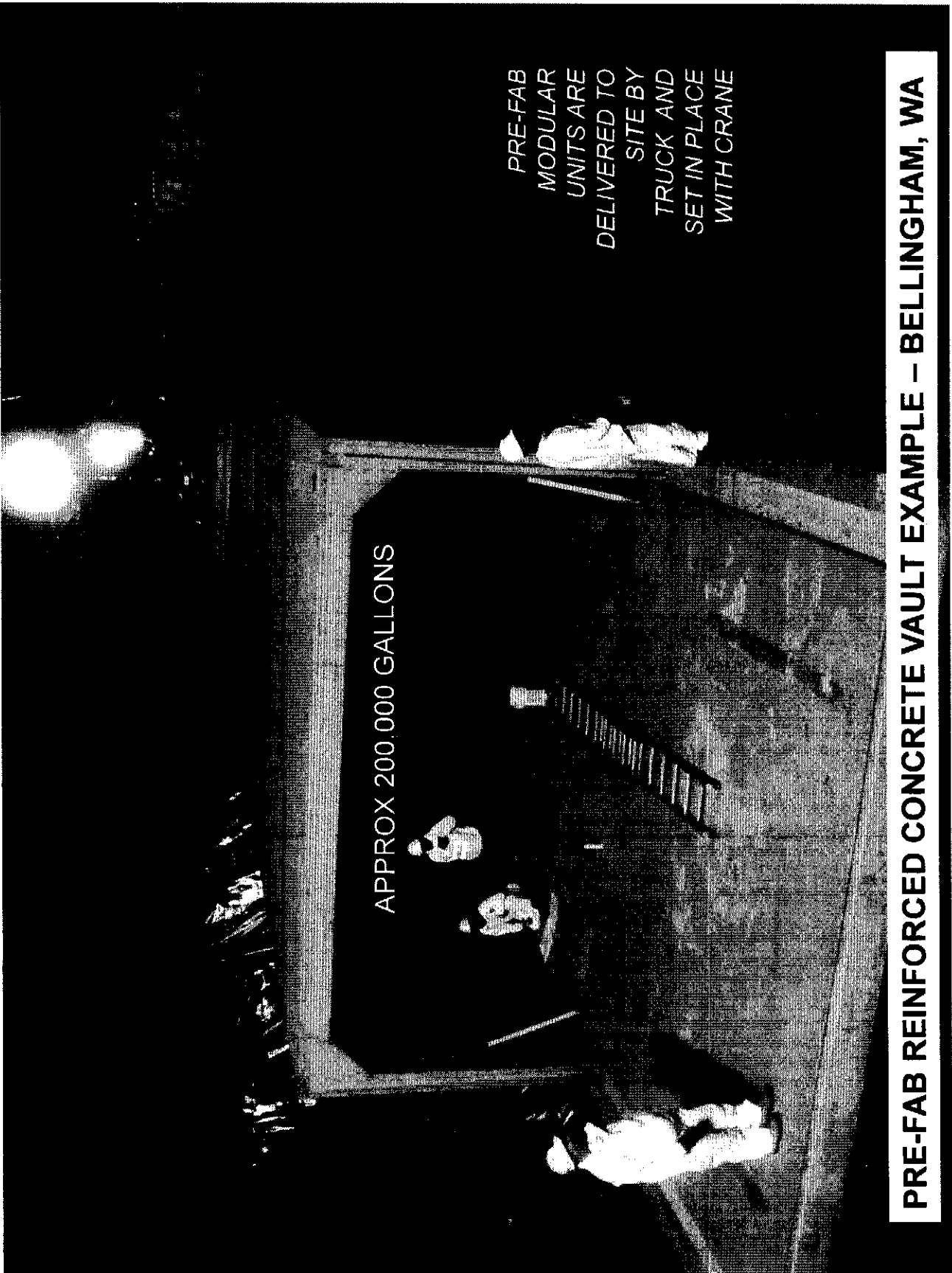
- 94% VOID RATIO
- SHALLOWER REQUIRES BROADER FOOTPRINT
- MAY BE LOAD RESTRICTIONS
- GENERALLY LESS EXPENSIVE

* BOTH REQUIRE SEDIMENTATION VAULT FRONT ENDS



APPROX 60,000 GALLONS

PRE-FAB REINFORCED CONCRETE VAULT EXAMPLE - SEATTLE, WA



APPROX 200,000 GALLONS

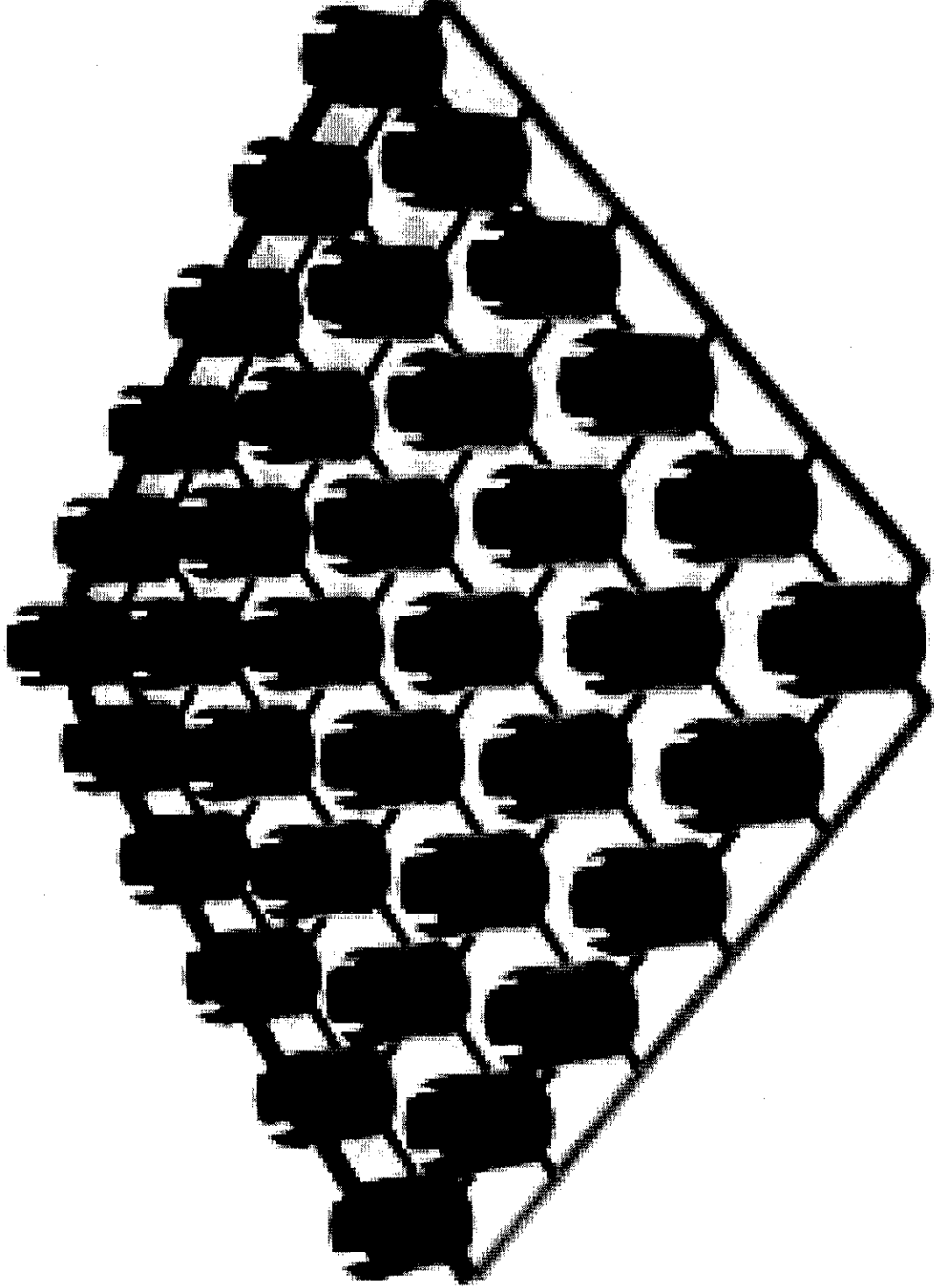
PRE-FAB
MODULAR
UNITS ARE
DELIVERED TO
SITE BY
TRUCK AND
SET IN PLACE
WITH CRANE

PRE-FAB REINFORCED CONCRETE VAULT EXAMPLE – BELLINGHAM, WA

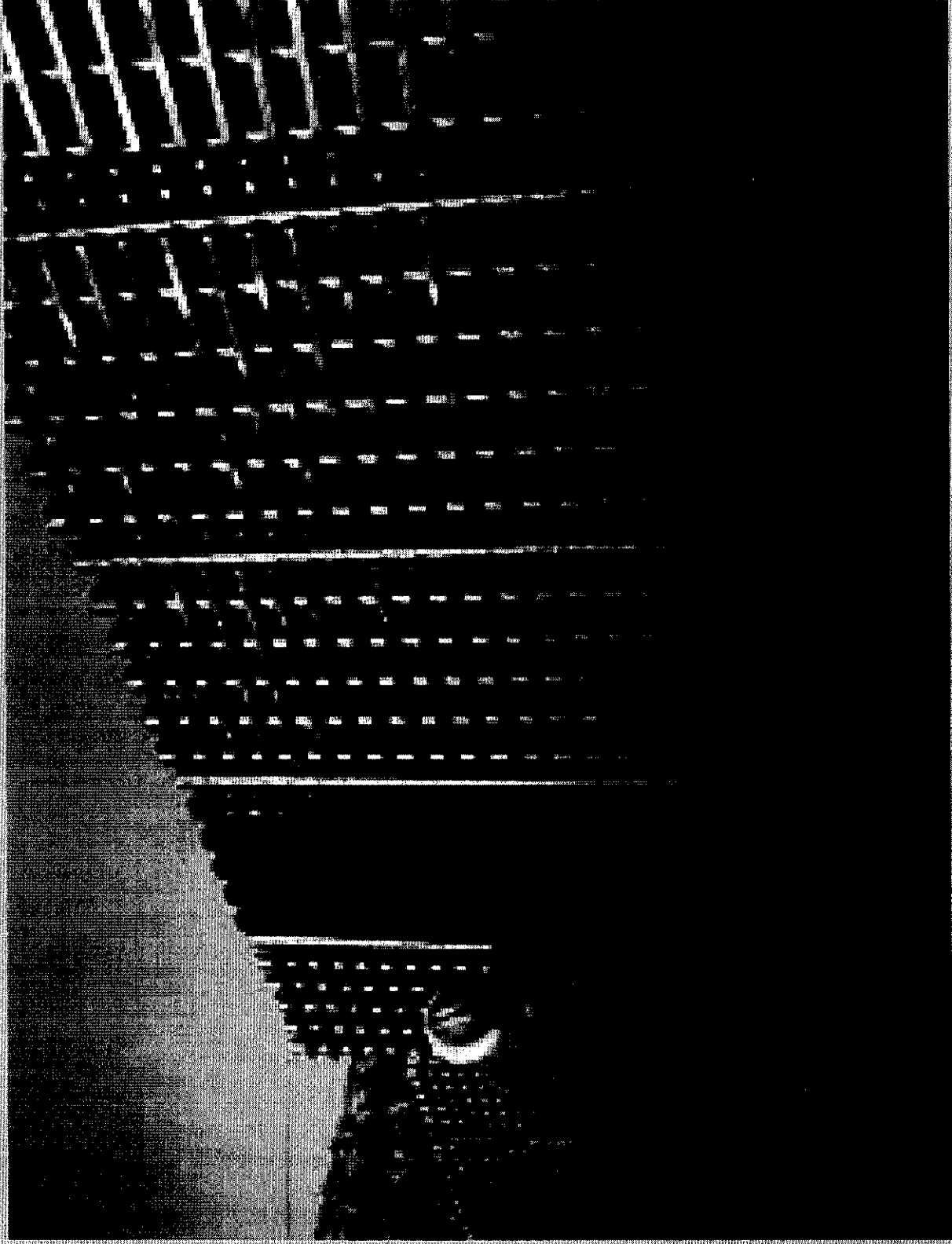


MODULAR
PLASTIC UNITS
ARE
DELIVERED
TO SITE BY
TRUCK AND
SET IN PLACE
WITH LIGHT
EQUIPMENT
AND BY HAND

EXAMPLE PLASTIC CELLULAR MATRIX VAULT INSTALLATION

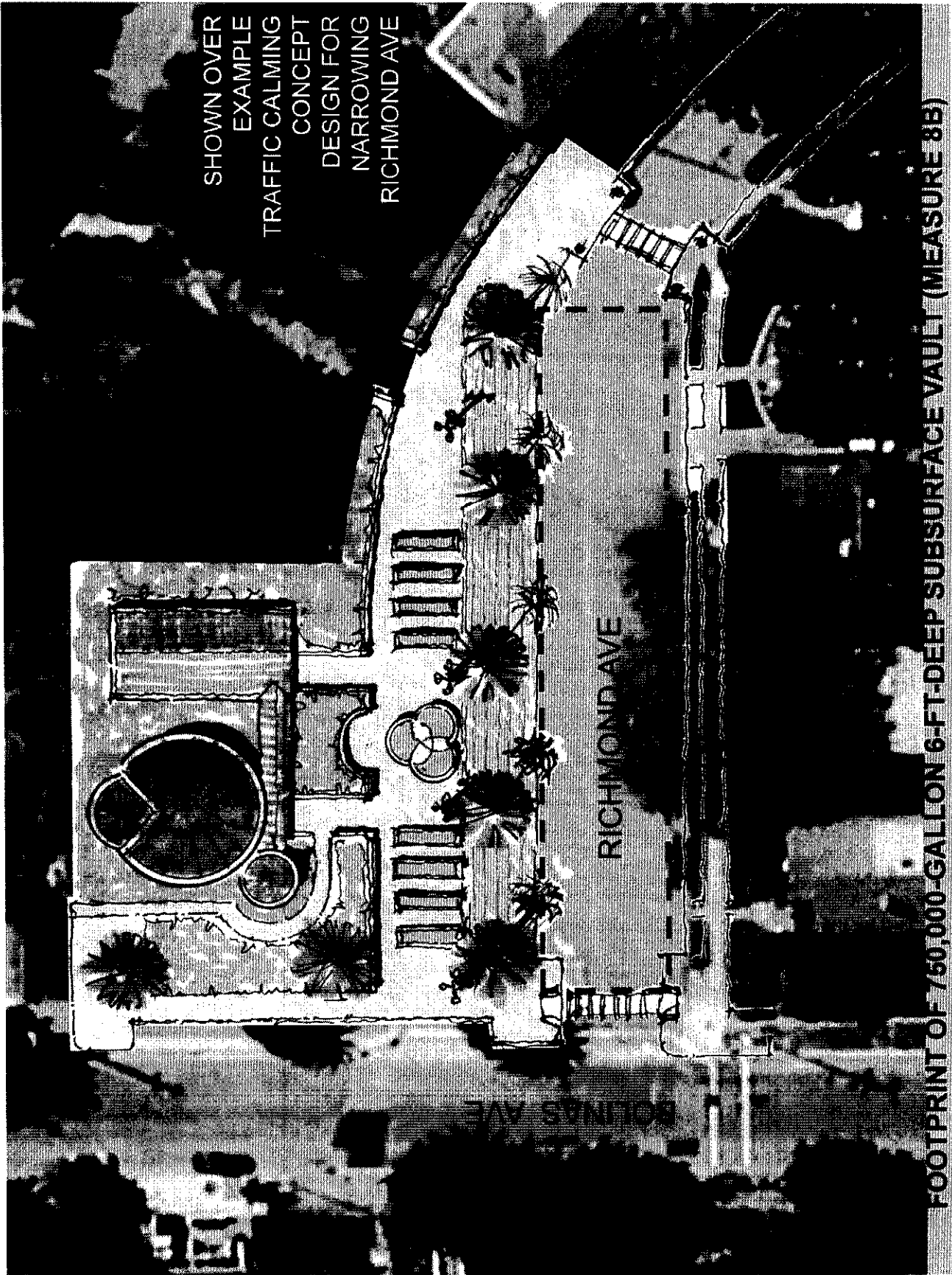


EXAMPLE PLASTIC CELLULAR MATRIX (MODULAR STRUCTURAL ELEMENT)



EXAMPLE PLASTIC CELLULAR MATRIX VAULT INSTALLATION

SHOWN OVER
EXAMPLE
TRAFFIC CALMING
CONCEPT
DESIGN FOR
NARROWING
RICHMOND AVE



FOOTPRINT OF 750,000-GALLON 6-FT-DEEP SUBSURFACE VAULT (MEASURE 8B)