Multi-Benefit Design Solutions to Manage Sea Level Rise
Sea Level Rise Adaptation in Marin County Workshop

Sarah Moos Thompson, Senior Associate, Bionic
March 21, 2019
Meet the Projects

- The Estuary Commons | All Bay Collective
  San Leandro Bay

- Resilient South City | HASSELL+
  South San Francisco

- The Grand Bayway | Common Ground
  San Pablo Bay

- Unlock Alameda Creek | Public Sediment
  Alameda Creek

- South Bay Sponge | Field Operations Team
  East Palo Alto to Sunnyvale

- Islais Hyper-Creek | BIG+ONE+Sherwood
  Islais Creek

- Peoples Plan | P+SET
  Marin City

- Elevate San Rafael | Bionic Team
  San Rafael

- ouR-HOME | The Home Team
  North Richmond
bionic
PennDesign
WXY architecture + urban design
Studio for Urban Projects

Enterprise Partners
M Yarne
SF State University
Keyser Marston Associates
WRA Environmental
RAD Urban
Moffatt & Nichol
it’s a metropolis...

it’s interconnected...
focus on the lowest areas... on those who need help first
accelerate!
Radar data showing ground displacement. The area in San Rafael Bay appears to show a range from 10 to 20 mm/yr, which could equal 15” by 2040. [http://www.esa.int/spaceinimages/Images/2016/11/Bay_Area_displacement](http://www.esa.int/spaceinimages/Images/2016/11/Bay_Area_displacement)
everything moves through these spaces
everything moves through these spaces
tides + sediments
refinery + port logistics
everything moves through these spaces
tides + sediments
refinery + port logistics
commerce
everything moves through these spaces
tides + sediments
refinery + port logistics
commerce
energy
everything moves through these spaces
tides + sediments
refinery + port logistics
dery commerce
energy
mobility
San Rafael today
San Rafael creek
Bay Trail
habitat potential & restoration
heavily used Pickleweed Park
low lying & weak infrastructure
bridges & connectivity
failing marine structures
outdated & low lying housing
Housing shortage
San Rafael today
Is there a waterfront in San Rafael?

The waterfront?

When I think of San Rafael, waterfront doesn’t come to mind.

Is it??

I don’t think so...

We have nothing known to me as the waterfront, and I was born here.

I don’t know...

No...

Is there a waterfront in San Rafael?
the community
community stats

PREDOMINANT RACE/ETHNICITY
HISPANIC

MEDIUM HOUSEHOLD INCOME
$43,448.50

FOREIGN BORN
60%

IMMIGRATED IN LAST 10 YEARS
36%

LIVING IN POVERTY
2,920 FAMILIES

COST BURDENED RENTER
71%

PERCENT WORK LESS THAN 10 MILES FROM HOME
50.8%

PERCENT WORK IN SAN RAFAEL
24%
FLOOD MODEL
My car!
¡Mi auto!

Sorry boss,
still stuck at home...
Lo siento jefe, todavía estoy atrapado en casa

I live on a hill,
why do I care?!
Vivo en una colina, ¿por qué me importa?
POTUS...even stick figures know climate change is real!

POTUS ...¡incluso las figuras de palo saben que el cambio climático es real!
key takeaways

Protect the community center
Improve parking
Improve traffic
“Make San Rafael liveable for ALL now and in the future”

Protect the schools and health center
Need affordable housing options
Improve access
Identify multi-benefit projects
What is at Risk?
San Rafael will subside 15” by 2040
City of San Rafael

ASSETS AT RISK

500-year event

5,423 residential units

12,826 jobs

$3.95 B land value

$2.95 B business revenue
history
pump failure scenarios
flood depths in feet
pump failure scenarios
flood depths in feet

2018 – 6.6 ft MHHW
pump failure scenarios
flood depths in feet
2040 – 7.87 ft MHHW
pump failure scenarios
flood depths in feet

2060 – 10.06 ft MHHW
housing risk

+ 4.5 ft flooding

There is a 1 in 4 chance this will happen by 2050
evolving risk

decisions + time
elevating the short term
catalyst project 1 // Resilience Now
Pickleweed park today
Protect Pickleweed Park
upgraded community sports facility
community event space
emergency response center
catalyst project 2 //

BUY TIME
enhance connectivity + protection

COMPLETE THE BAY TRAIL:
Create a Class-I multi-use path
Upgrade utilities
Increase access and protection

CONNECT TO EXISTING LEVEE:
Remains in place with protection to mid-century
Existing corroding corrugated metal pipes
complete the Bay Trail
Raised Class-I multi-use path
Upgraded + elevated utilities
Flood Gate
Option B // prepared for water
single property
retrofit + upgrade

- Flood Proofing
- Raised Ground Floor
- Floodable Ground Floor
- Wall
- Wet Flood Proofing
- Mound
- Floating
catalyst project 3 //
new forms of living
2060

NEW HOUSING + BUSINESSES
On underutilized adjacent site
Connect high ground for protection

HIGH GROUND

new housing + businesses
community spaces
new neighborhood + marsh
the marsh
catalyst project 4  //  the canal
canal ecology //
floating wetlands
canal ecology //
floating wetlands
canal ecology //
floating wetlands
canal

new perception
catalyst project 5 //
the reef
existing ecology
edge biodiversity

SEDIMENT FLOWS

REEF (R)
FINE SEDIMENT LENS (FSL)
TOWER
MUDFLAT
REEF BALL
CONSTRUCTED REEF
SALT MARSH
BRACKISH MARSH
EELGRASS
ROCKY INTERTIDAL
multiply ecological diversity
reef ecology
reef research lab
stewardship + recreation
elevating: the long term
SMALLER FORMAT

HIGHER

PERFORMING

LAND USES

RETAIL
MOBILITY

DECREASE IN OWNERSHIP
NEW SALES & SERVICE MODELS
NEW LOGISTICS MODELS & PATTERNS
NEW INCENTIVES PROGRAMS MARKETS INSURANCE
shifting land uses
2100

COMPLETE THE BAY TRAIL
Near term protection

LONG TERM SPINE
- Primary roads as critical infrastructure
  - Provides safe access and utilities
  - Acquire properties along these roads for future-proofing

HIGH GROUND

acquisition + evolution
Kerner Blvd
new infrastructure
Francisco Blvd

today // commercial + auto
Francisco Blvd

new infrastructure
San Rafael +
the metropolis
NEXT STEPS

Identify
San Rafael is a nexus of the bay area economy.

Lead
To advance planning, policy, and financing efforts

Prioritize
Planning and infrastructure for the watershed and the waterfront

Organize
- All people of San Rafael
- Policy mechanisms
- A new process

Start
bionic
PennDesign
WXY architecture + urban design
Studio for Urban Projects

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M. Yarne
SF State University
Keyser Marston Associates
WRA Environmental
RAD Urban
Moffatt & Nichol

SAN RAFAEL
South End Living Shorelines Project

Kate Bimrose
Bolinas Lagoon Project Manager
March 21, 2019
SLR Adaptation Workshop
PROJECT NEED: Communities surrounding the South End of Bolinas Lagoon face frequent flooding that is likely to worsen with sea level rise and increased storm intensity. If habitat in this area is not restored, flooding will all but eliminate important refugia for plant and wildlife species and undermine access/safety of surrounding trails and roads.

PROJECT AREA: The South End project encompasses the eastern span of Dipsea Road in the Seadrift community and Calle del Arroyo Road in Stinson Beach.
Shoreline along the eastern section of Dipsea Road is eroding, causing a steep scarp that drops upwards of 10 ft to the lagoon. Continued erosion will:

- Limit habitat refugia for plants and animals as water levels rise
- Contribute increased sedimentation/fill into the lagoon
- Eventually undermine the local walking path, and eventually Dipsea Road, and nearby homes
Calle del Arroyo frequently floods during storms and high tide events, particularly at a ~500ft section that dips as low as 7.5ft NAVD88.

Past 5 years = 29 events with water levels >7ft NAVD88 and 6 events with water levels >7.5ft NAVD88 in Bolinas Lagoon

Continued high water events:
- Flood the only access road in and out of Stinson Beach patios/calles and Seadrift community
- Turn marsh/intertidal habitat into subtidal habitat, drowning important wetlands that could act as a buffer to protect to the road
- Threaten nearby homes and utilities
Thank you!

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Greater Farallones Association
Calle del Arroyo

- Flow from Easkoot Creek to Bolinas Lagoon
- Wetland Area
- Low lying berm (Elev 7 ft NAVD)
- Lowest lying roadway segment (~7.5 ft NAVD)
Dipsea Road
Dunphy Park Nature-Based Wave Attenuator
Conservation Corps North Bay
Existing Eelgrass and Oyster beds
Proposed Sheet Pile Breakwater

SOURCE: Google Earth, WB Clausen Structural Engineers 2014, SF Bay Subtidal Goals 2014
Responding to SLR in Corte Madera Creek
Two Project Cameos

Sandy Guldman
March 21, 2019
PHASE 1 - EXISTING AND PROPOSED CONDITIONS
PHASE 1 - CROSS SECTION 321+50 (FACING DOWNSTREAM)
PHASE 1 - CROSS SECTION 391+70 (FACING DOWNSTREAM)
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MILLER AVENUE

By the numbers....

18 Month Construction Period
18 Million Dollars
2 Miles Bike Lanes with Buffers
160 Trees
31 Painted Crosswalks
8 Raingardens
63 Bike Friendly Back-in Diagonal Parking Spaces
Sea Level Rise
100yr storm + 3m SLR

Storm Flooding

MILLER AVENUE | SLR & ADAPTATION
Invasive Spartina Project

- Bay-wide project of Coastal Conservancy
- Work began in Corte Madera Creek in 2003
- 12 acres of invasive cordgrass
- Four invasive species, one native
- More than 95% eliminated by 2018
Santa Venetia Flood Control Zone #7

TIMBER REINFORCED BERM IMPROVEMENT PROJECT

GERHARD EPKE
Development 1930s - 1970s

WWW.MARINWATERSHEDS.ORG
Santa Venetia Today

WWW.MARINWATERSHEDS.ORG
Chronic Flooding until 1984
Pump Stations, Bypass Drainage, Levee
1983 Timber Berm through 115 yards

WWW.MARINWATERSHEDS.ORG
TIMBER REINFORCED BERM IMPROVEMENT PROJECT
GERHARD E Pike