Santa Pola (ES)

panarchy cycles 3p4o

initiation and hacking of the process while the planning documents obtain approval

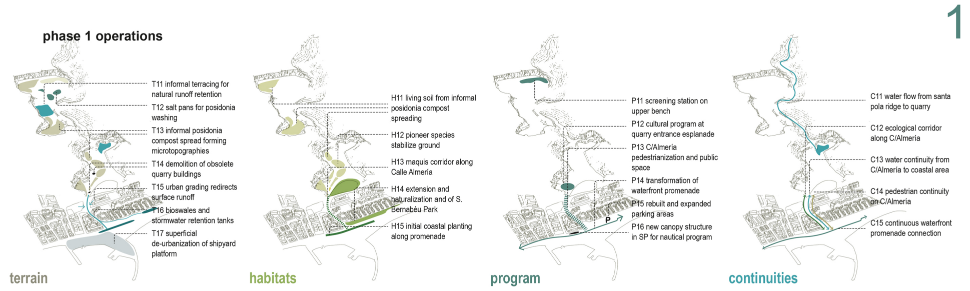
panarchy cycles 3p4o **is a strategic masterplan for the ecological regeneration of the post-extractivist Varadero-Cantera site in Santa Pola. It unfolds in four types of operations developed across three phases. Inspired by resilience theory, this proposal understands landscape as an active agent in sustaining the practices that characterize a place. By working with ecological functions, spatial continuities, and cultural logics, the project initiates regenerative processes that re-signify the territory over time.**

phase 1 TACTICAL

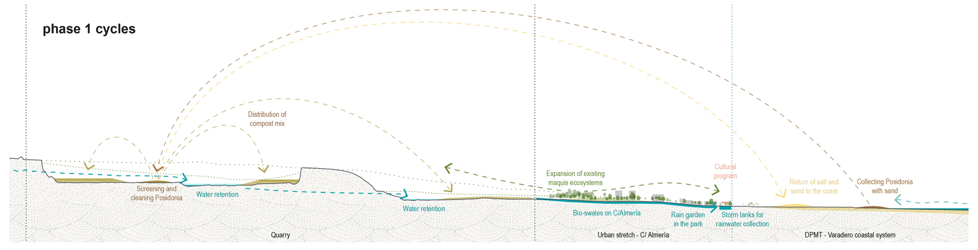
Phase 1 initiates regeneration through reversible, small-scale actions that anticipate formal planning and embrace time as a design tool. It works with available materials, organic processes, and legal ambiguities to activate the site ecologically and socially. These interventions include terrain conditioning, pioneer planting, and temporary programs that begin to reconfigure flows, restore cycles, and invite public engagement. By testing possibilities without closing options, this phase sets the groundwork for transformation through productive disturbance, opening new paths for adaptive continuity.

1

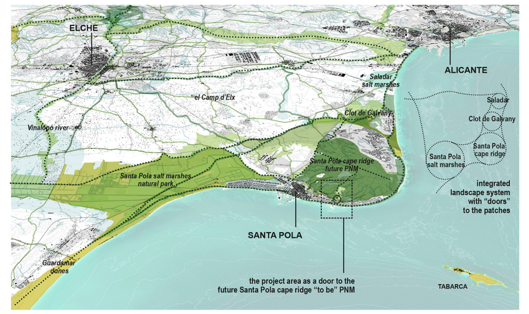
phase 1 operations


T11 informal terracing for natural runoff retention
T12 salt pans for posidonia washing
T13 informal posidonia compost spread forming microtopographies
T14 demolition of obsolete quarry buildings
T15 urban grading redirects surface runoff
T16 bioswales and stormwater retention tanks
T17 superficial de-urbanization of shipyard platform
H11 living soil from informal posidonia compost spreading
H12 pioneer species stabilize ground
H13 maquis corridor along Calle Almería
H14 extension and naturalization and of S. Bernabéu Park
H15 initial coastal planting along promenade
P11 screening station on upper bench
P12 cultural program at quarry entrance esplanade
P13 C/Almería pedestrianization and public space
P14 transformation of waterfront promenade
P15 rebuilt and expanded parking areas
P16 new canopy structure in SP for nautical program
C11 water flow from santa pola ridge to quarry
C12 ecological corridor along C/Almería
C13 water continuity from C/Almería to coastal area
C14 pedestrian continuity on C/Almería
C15 continuous waterfront promenade connection
terrain
habitats
program
continuities

phase 1 cycles

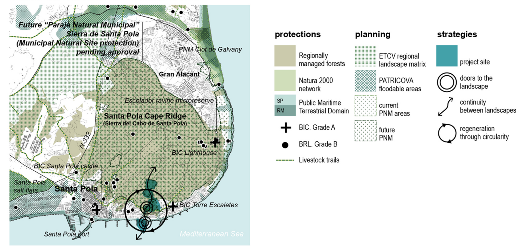

Distribution of compost mix
Screening and cleaning Posidonia
Water retention
Water retention
Expansion of existing maquis ecosystems
Cultural program
Return of salt and sand to the coast
Collecting Posidonia with sand
Bio-swales on C/Almeria
Rain garden in the park
Storm tanks for rainwater collection
Quarry
Urban stretch - C/ Almeria
DPMT - Varadero coastal system

towards territorial rebalancing through an integrated landscape system


ELCHE
ALICANTE
Saladar salt marshes
el Camp d'Elx
Clot de Galvany
Saladar
Clot de Galvany
Vinalopó river
Santa Pola cape ridge future PNM
Santa Pola salt marshes
Santa Pola cape ridge
Santa Pola salt marshes natural park
integrated landscape system with "doors" to the patches
SANTA POLA
Guardamar dunes
the project area as a door to the future Santa Pola cape ridge "to be" PNM
TABARCA

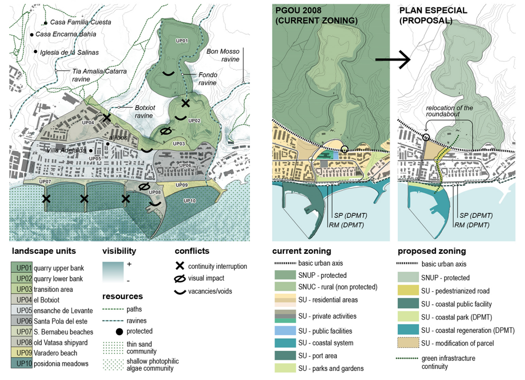
initiation of a strategic approach to the burocratic-administrative procedure

approach to the Initial Strategic Document (DIE)
Ley 21/2013, de 9 de diciembre, de evaluación ambiental

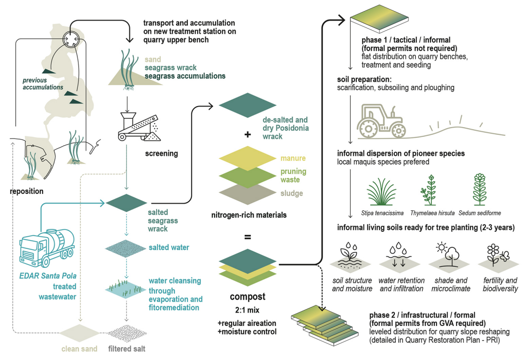

Future "Paraje Natural Municipal" Sierra de Santa Pola (Municipal Natural Site protection) pending approval
PNM Clot de Galvany
Gran Alacant
Escolador ravine microreserve
Santa Pola Cape Ridge (Sierra del Cabo de Santa Pola)
N-332
BIC Lighthouse
BIC Santa Pola castle
Santa Pola salt flats
Santa Pola
BIC Torre Escaletes
Santa Pola port
Mediterranean Sea
protections
Regionally managed forests
Natura 2000 network
SP
RM
Public Maritime Terrestrial Domain
BIC. Grade A
BRL. Grade B
Livestock trails
planning
ETCV regional landscape matrix
PATRICOVA floodable areas
current PNM areas
future PNM
strategies
project site
doors to the landscape
continuity between landscapes
regeneration through circularity

approach to the Landscape Integration Study (EIP)
Art. 36 TRLOTUP (Decreto Legislativo 1/2021)

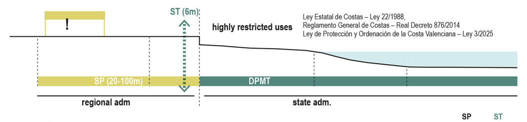
approach to the Spetial Plan (PE)
Art. 43 TRLOTUP (Decreto Legislativo 1/2021)


Casa Familia Cuesta
Casa Encarna Bahía
Iglesia de la Salinas
Tía Amalia Catarra ravine
Bon Mosso ravine
Fondo ravine
Botxiot ravine
UP01
UP02
UP03
UP04
UP05
UP06
UP07
UP08
UP09
UP10
PGOU 2008 (CURRENT ZONING)
PLAN ESPECIAL (PROPOSAL)
relocation of the roundabout
SP (DPMT)
RM (DPMT)
landscape units
UP01 quarry upper bank
UP02 quarry lower bank
UP03 transition area
UP04 el Botxiot
UP05 ensanche de Levante
UP06 Santa Pola del este
UP07 S. Bernabeu beaches
UP08 old Vatasa shipyard
UP09 Varadero beach
UP10 posidonia meadows
visibility
resources
paths
ravines
protected
thin sand community
shallow photophilic algae community
conflicts
continuity interruption
visual impact
vacancies/voids
current zoning
basic urban axis
SNUP - protected
SNUC - rural (non protected)
SU - residential areas
SU - private activities
SU - public facilities
SU - coastal system
SU - port area
SU - parks and gardens
proposed zoning
basic urban axis
SNUP - protected
SU - pedestrianized road
SU - coastal public facility
SU - coastal park (DPMT)
SU - coastal regeneration (DPMT)
SU - modification of parcel
green infrastructure continuity

initation of the process to provide a living soil from Posidonia seagrass wrecks


transport and accumulation on new treatment station on quarry upper bench
previous accumulations
sand
seagrass wrack
seagrass accumulations
screening
reposition
de-salted and dry Posidonia wrack
manure
pruning waste
sludge
nitrogen-rich materials
salted seagrass wrack
salted water
water cleansing through evaporation and fitoremediation
EDAR Santa Pola treated wastewater
compost
2:1 mix
+regular aireation
+moisture control
clean sand
filtered salt
phase 1 / tactical / informal (formal permits not required) flat distribution on quarry benches, treatment and seeding
soil preparation: scarification, subsoiling and ploughing
informal dispersion of pioneer species local maquis species prefered
Stipa tenacissima
Thymelaea hirsuta
Sedum sediforme
informal living soils ready for tree planting (2-3 years)
soil structure and moisture
water retention and infiltration
shade and microclimate
fertility and biodiversity
phase 2 / infrastructural / formal (formal permits from GVA required) leveled distribution for quarry slope reshaping (detailed in Quarry Restoration Plan - PRI)

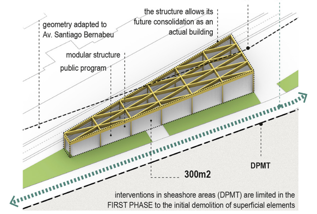
initation of the interventions in the Varadero DPMT area prior to obtaing a favorable report from the Coastal Authority for environmental regeneration


!
ST (6m)
highly restricted uses
Ley Estatal de Costas – Ley 22/1988,
Reglamento General de Costas – Real Decreto 876/2014
Ley de Protección y Ordenación de la Costa Valenciana – Ley 3/2025
SP (20-100m)
DPMT
regional adm
state adm.

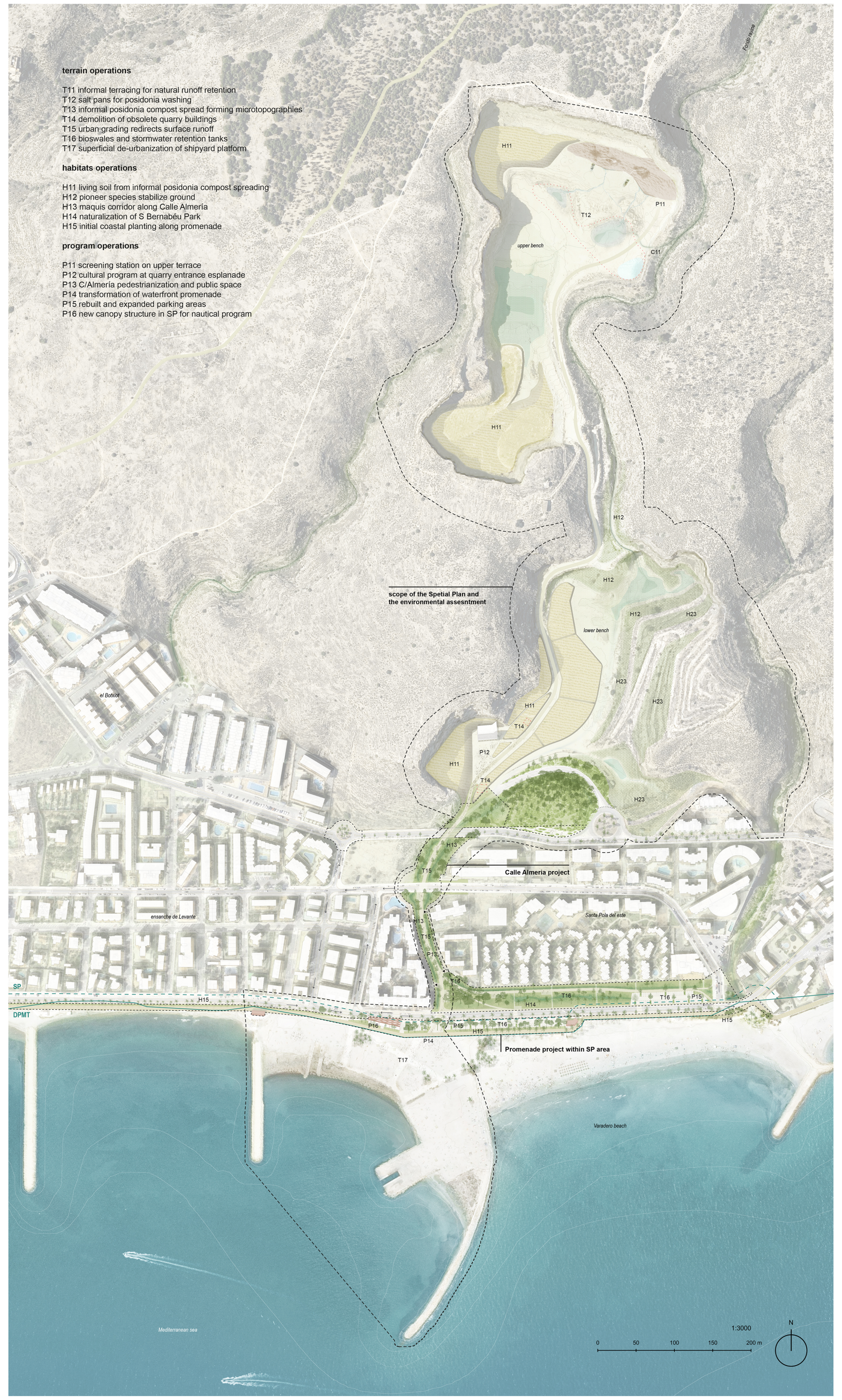
seashore (DPMT)
Area where the sea meets the land, up to the point reached by the highest tides and storms.

protection easement zone (SP) (20m)
A 20-meter inland strip with restricted use to safeguard the coastal environment.

transit easement (ST) (6m)
6-meter strip along the DPMT ensuring free pedestrian access.


geometry adapted to Av. Santiago Bernabeu
the structure allows its future consolidation as an actual building
modular structure
public program
SP
ST
300m2
DPMT
interventions in sheashore areas (DPMT) are limited in the FIRST PHASE to the initial demolition of superficial elements

in the SP area a new structure hosts nautical cultural and sports activities, while complying with coastal regulations:
- +removable, with no permanent foundations
- +located within the Protection Easement Zone, respecting the 20–100 m setback
- +dedicated to compatible uses linked to nautical activity
- +built area extension does not exceed 300 m²
- +preserves the natural landscape
- +guarantees public access
- +does not interfere with coastal dynamics
- +can be in the futer turned into a enclosed building maintaining structure



terrain operations

T11 informal terracing for natural runoff retention
T12 salt pans for posidonia washing
T13 informal posidonia compost spread forming microtopographies
T14 demolition of obsolete quarry buildings
T15 urban grading redirects surface runoff
T16 bioswales and stormwater retention tanks
T17 superficial de-urbanization of shipyard platform

habitats operations

H11 living soil from informal posidonia compost spreading
H12 pioneer species stabilize ground
H13 maquis corridor along Calle Almeria
H14 naturalization of S Bernabéu Park
H15 initial coastal planting along promenade

program operations

P11 screening station on upper terrace
P12 cultural program at quarry entrance esplanade
P13 C/Almeria pedestrianization and public space
P14 transformation of waterfront promenade
P15 rebuilt and expanded parking areas
P16 new canopy structure in SP for nautical program

Fondo ravine
upper bench
lower bench
scope of the Spetial Plan and the environmental assesntment
el Botxiot
Calle Almeria project
ensanche de Levante
Santa Pola del este
SP
DPMT
Promenade project within SP area
Varadero beach
Mediterranean sea
1:3000
0
50
100
150
200 m
N

Santa Pola (ES)

panarchy cycles 3p4o

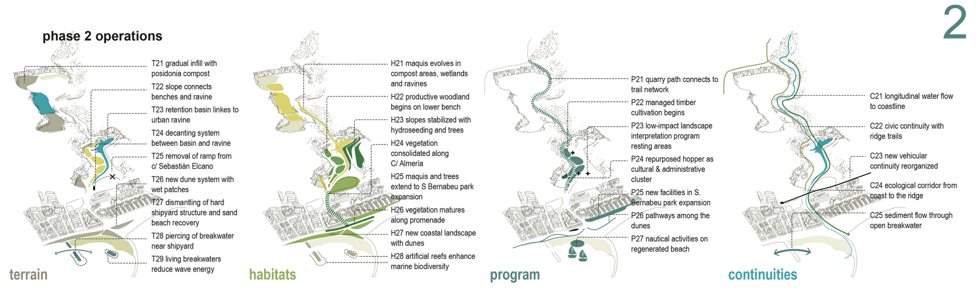
infrastructural works start once planning has been approved by authorities

phase 2 INFRASTRUCTURAL

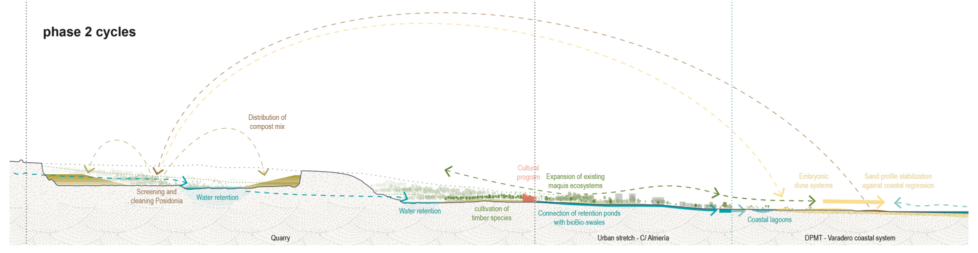
Phase 2 consolidates the transformation initiated tactically by introducing long-term infrastructures rooted in ecological and cultural logics. It works through formal planning channels, enabling topographic reconfiguration, hydrological recovery, and ecological connectivity at greater depth and scale. Landscape and infrastructure merge to form resilient systems—dune regeneration, water management, biotic corridors—while previous temporary uses evolve into more stable, community-oriented programs. The quarry is reintegrated into the ecological matrix; the shoreline becomes a dynamic buffer. Rather than imposing form, infrastructure acts as a scaffold for ongoing processes and renewed territorial continuity.

2

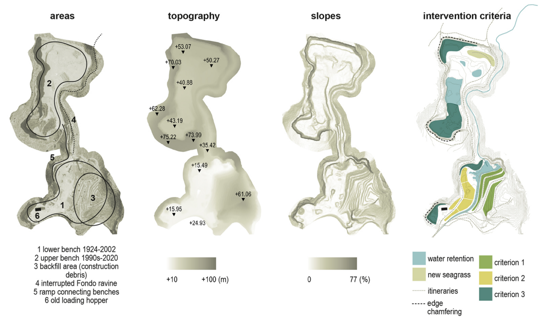
phase 2 operations


T21 gradual infill with posidonia compost
T22 slope connects benches and ravine
T23 retention basin linkes to urban ravine
T24 decanting system between basin and ravine
T25 removal of ramp from c/ Sebastián Elcano
T26 new dune system with wet patches
T27 dismantling of hard shipyard structure and sand beach recovery
T28 piercing of breakwater near shipyard
T29 living breakwaters reduce wave energy
H21 maquis evolves in compost areas, wetlands and ravines
H22 productive woodland begins on lower bench
H23 slopes stabilized with hydroseeding and trees
H24 vegetation consolidated along C/ Almería
H25 maquis and trees extend to S Bernabeu park expansion
H26 vegetation matures along promenade
H27 new coastal landscape with dunes
H28 artificial reefs enhance marine biodiversity
P21 quarry path connects to trail network
P22 managed timber cultivation begins
P23 low-impact landscape interpretation program resting areas
P24 repurposed hopper as cultural & administrative cluster
P25 new facilities in S. Bernabeu park expansion
P26 pathways among the dunes
P27 nautical activities on regenerated beach
C21 longitudinal water flow to coastline
C22 civic continuity with ridge trails
C23 new vehicular continuity reorganized
C24 ecological corridor from coast to the ridge
C25 sediment flow through open breakwater
terrain
habitats
program
continuities

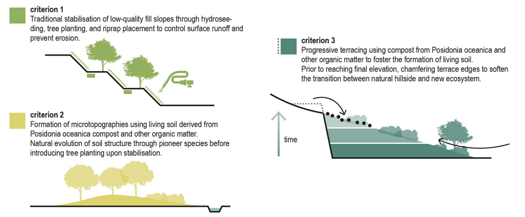
phase 2 cycles


Distribution of compost mix
Screening and cleaning Posidonia
Water retention
Water retention
cultivation of timber species
Cultural program
Expansion of existing maquis ecosystems
Connection of retention ponds with bioBio-swales
Embryonic dune systems
Sand profile stabilization against coastal regression
Coastal lagoons
Quarry
Urban stretch - C/ Almeria
DPMT - Varadero coastal system

criteria for the quarry Integral Restorarion Plan (PRI)


areas
topography
slopes
intervention criteria
1 lower bench 1924-2002
2 upper bench 1990s-2020
3 backfill area (construction debris)
4 interrupted Fondo ravine
5 ramp connecting benches
6 old loading hopper
+53.07
+70.03
+50.27
+40.88
+62.28
+43.19
+75.22
+73.99
+35.42
+15.49
+61.06
+15.95
+24.93
+10
+100 (m)
0
77 (%)
water retention
new seagrass
itineraries
edge chamfering
criterion 1
criterion 2
criterion 3

type interventions

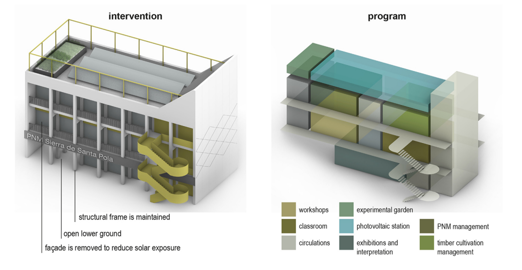


criterion 1
Traditional stabilisation of low-quality fill slopes through hydroseeding, tree planting, and riprap placement to control surface runoff and prevent erosion.

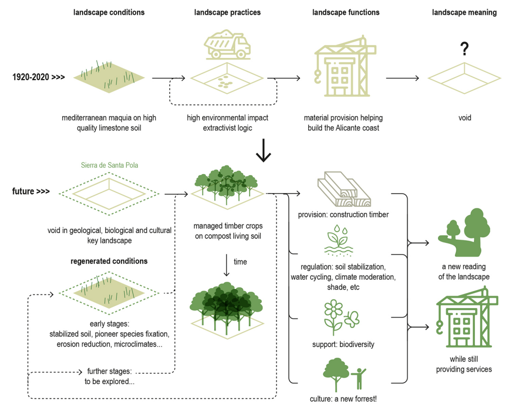
criterion 2
Formation of microtopographies using living soil derived from Posidonia oceanica compost and other organic matter.
Natural evolution of soil structure through pioneer species before introducing tree planting upon stabilisation.

criterion 3
Progressive terracing using compost from Posidonia oceanica and other organic matter to foster the formation of living soil.
Prior to reaching final elevation, chamfering terrace edges to soften the transition between natural hillside and new ecosystem.

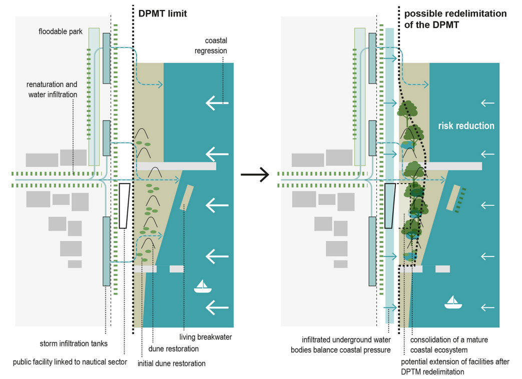
transformation of the old loading hoppper into an interpretation, research and administration cluster for the Santa Pola cape ridge PNM


intervention
program
PNM Sierra de Santa Pola
structural frame is maintained
open lower ground
façade is removed to reduce solar exposure
workshops
classroom
circulations
experimental garden
photovoltaic station
exhibitions and interpretation
PNM management
timber cultivation management

timber crops in the quarry as circular productive landscape: resignification through regenerative provision ecosystem services

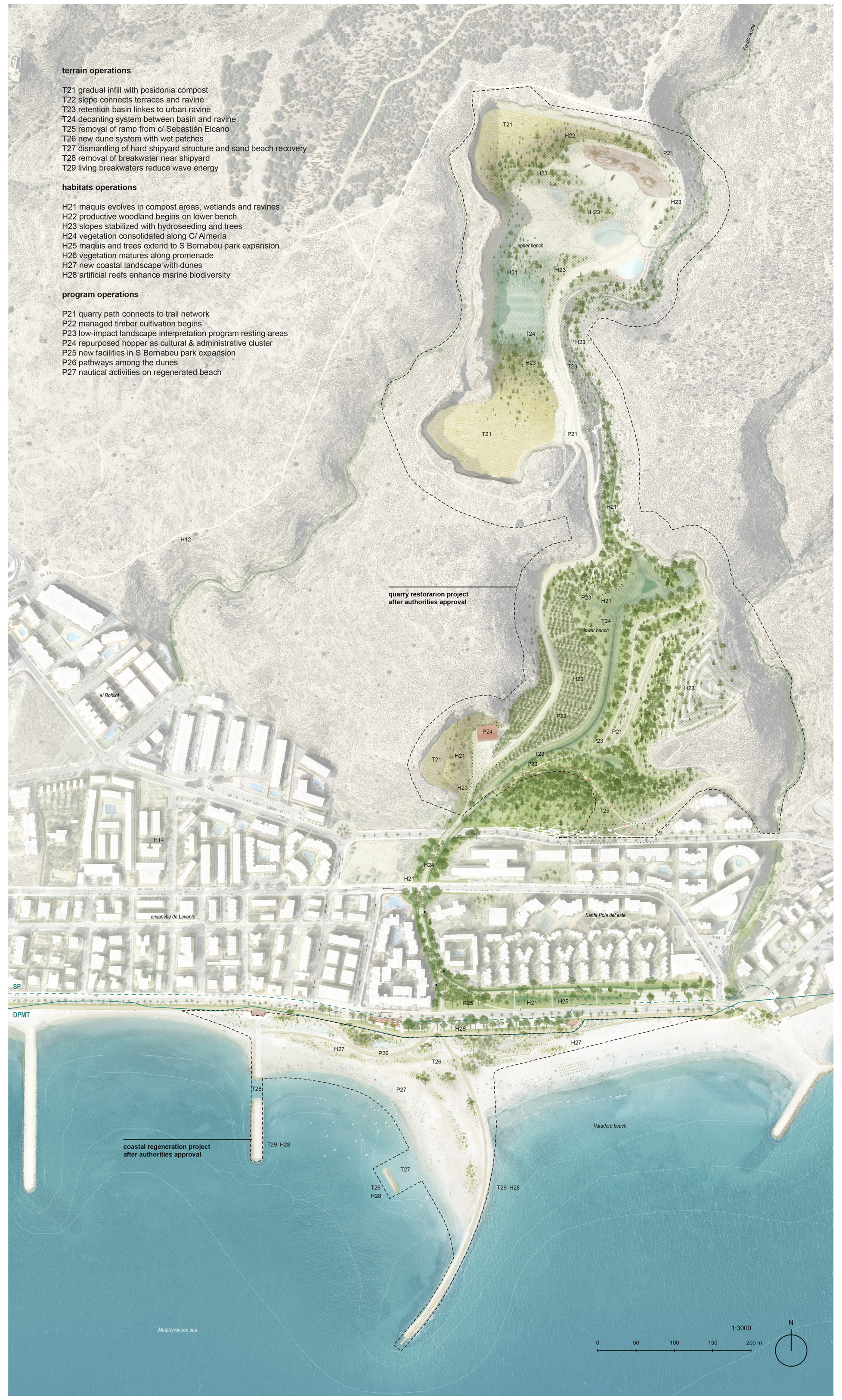

landscape conditions
landscape practices
landscape functions
landscape meaning
1920-2020 >>>
mediterranean maquia on high quality limestone soil
high environmental impact extractivist logic
material provision helping build the Alicante coast
?
void
future >>>
Sierra de Santa Pola
void in geological, biological and cultural key landscape
regenerated conditions
early stages: stabilized soil, pioneer species fixation, erosion reduction, microclimates...
further stages: to be explored...
managed timber crops on compost living soil
time
provision: construction timber
regulation: soil stabilization, water cycling, climate moderation, shade, etc
support: biodiversity
culture: a new forrest!
a new reading of the landscape
while still providing services

repurposing the Varadero costal system through time and ecology


DPMT limit
floodable park
coastal regression
renaturation and water infiltration
storm infiltration tanks
public facility linked to nautical sector
dune restoration
initial dune restoration
living breakwater
possible redelimitation of the DPMT
risk reduction
infiltrated underground water bodies balance coastal pressure
consolidation of a mature coastal ecosystem
potential extension of facilities after DPTM redelimitation

initial operations
a costal regeneration in the DPMT area aimed at recovering the natural reslience of an altered coastal system

a possible outcome
the consolidation of the ecological processes reduce coastal risk allowing a potential redelimitation of the protected DPMT area and therefore new uses



terrain operations

T21 gradual infill with posidonia compost
T22 slope connects terraces and ravine
T23 retention basin linkes to urban ravine
T24 decanting system between basin and ravine
T25 removal of ramp from c/ Sebastián Elcano
T26 new dune system with wet patches
T27 dismantling of hard shipyard structure and sand beach recovery
T28 removal of breakwater near shipyard
T29 living breakwaters reduce wave energy

habitats operations

H21 maquis evolves in compost areas, wetlands and ravines
H22 productive woodland begins on lower bench
H23 slopes stabilized with hydroseeding and trees
H24 vegetation consolidated along C/ Almeria
H25 maquis and trees extend to S Bernabeu park expansion
H26 vegetation matures along promenade
H27 new coastal landscape with dunes
H28 artificial reefs enhance marine biodiversity

program operations

P21 quarry path connects to trail network
P22 managed timber cultivation begins
P23 low-impact landscape interpretation program resting areas
P24 repurposed hopper as cultural & administrative cluster
P25 new facilities in S Bernabeu park expansion
P26 pathways among the dunes
P27 nautical activities on regenerated beach

Fondo ravine
upper bench
lower bench
quarry restorarion project after authorities approval
el Botxiot
ensanche de Levante
Santa Pola del este
SP
DPMT
coastal regeneration project after authorities approval
Varadero beach
Mediterranean sea
1:3000
0
50
100
150
200 m
N

Santa Pola (ES)

panarchy cycles 3p4o

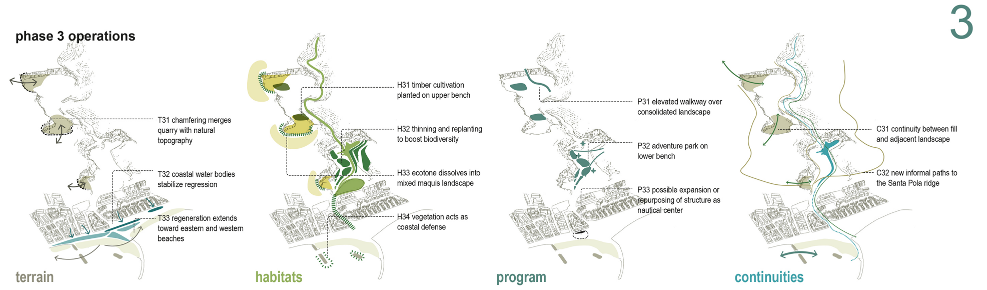
field operations stabylize, adapt and open new processes and cycles

phase 3 ADAPTIVE

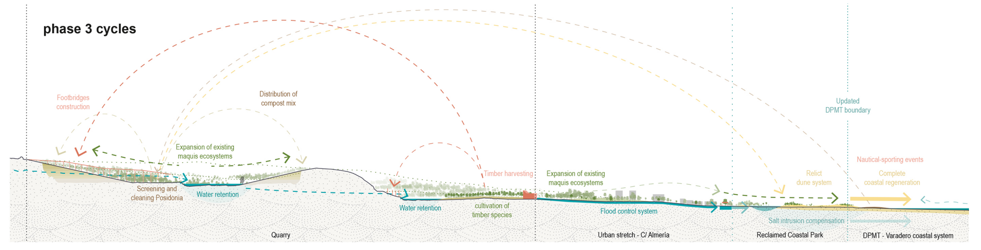
Phase 3 represents the maturation of the regenerative processes initiated in earlier stages, enabling more permanent uses and landscape integrations. Ecological systems, now stabilized, support complex habitats, productive plantations, and hybrid landforms where extraction scars dissolve into natural transitions. Coastal infrastructure becomes embedded in living systems, buffering erosion while hosting new programs. Cultural and recreational uses expand through lightweight, elevated structures built with site-grown materials, preserving ecological function. Informal trails and spontaneous uses are acknowledged as valid continuities. Rather than completing the project, this phase affirms its open-ended nature, allowing functions, forms, and meanings to evolve with time.

3

phase 3 operations

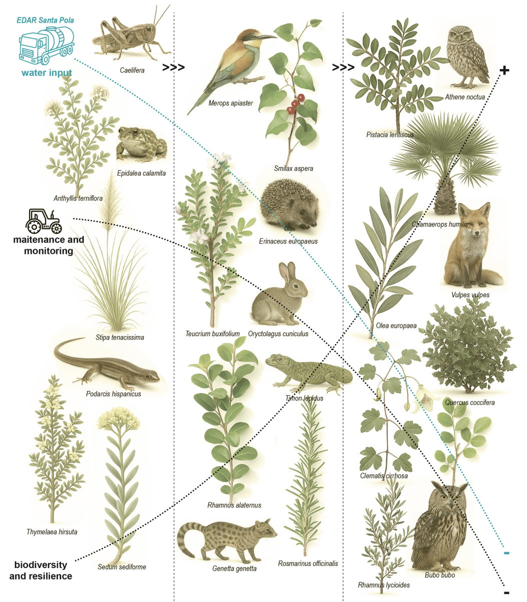

T31 chamfering merges quarry with natural topography
T32 coastal water bodies stabilize regression
T33 regeneration extends toward eastern and western beaches
H31 timber cultivation planted on upper bench
H32 thinning and replanting to boost biodiversity
H33 ecotone dissolves into mixed maquis landscape
H34 vegetation acts as coastal defense
P31 elevated walkway over consolidated landscape
P32 adventure park on lower bench
P33 possible expansion or repurposing of structure as nautical center
C31 continuity between fill and adjacent landscape
C32 new informal paths to the Santa Pola ridge
terrain
habitats
program
continuities

phase 3 cycles


Footbridges construction
Distribution of compost mix
Updated DPMT boundary
Expansion of existing maquis ecosystems
Screening and cleaning Posidonia
Water retention
Water retention
cultivation of timber species
Timber harvesting
Expansion of existing maquis ecosystems
Flood control system
Relict dune system
Nautical-sporting events
Complete coastal regeneration
Salt intrusion compensation
Quarry
Urban stretch - C/ Almeria
Reclaimed Coastal Park
DPMT - Varadero coastal system

curating the Santa Pola ridge maquis* habitat over time

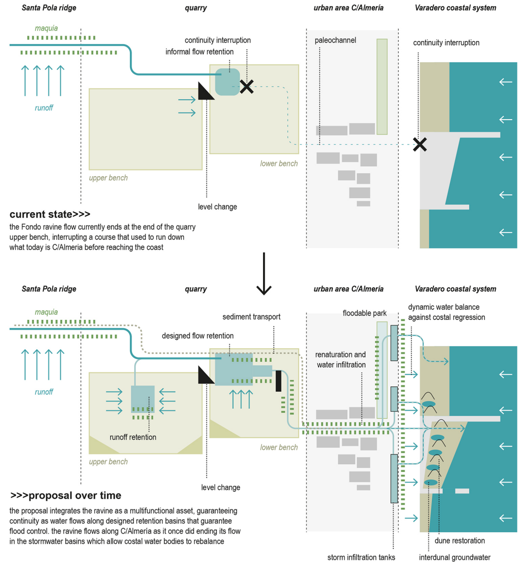
**maquis (or "maquia") is a type of dense, evergreen shrubland characteristic of the Mediterranean climate, composed mainly of hard-leaved shrubs and small trees.*


EDAR Santa Pola
water input
maitenance and monitoring
biodiversity and resilience
Caelifera
Epidalea calamita
Anthyllis terniflora
Stipa tenacissima
Podarcis hispanicus
Thymelaea hirsuta
Sedum sediforme
Merops apiaster
Smilax aspera
Erinaceus europaeus
Teucrium buxifolium
Oryctolagus cuniculus
Timon lepidus
Rhamnus alaternus
Genetta genetta
Rosmarinus officinalis
Pistacia lentiscus
Athene noctua
Chamaerops humilis
Vulpes vulpes
Olea europaea
Quercus coccifera
Clematis cirrhosa
Bubo bubo
Rhamnus lycioides
>>>
+
-

phase 1 >>> **phase 2** >>> **phase 3**

phase 1	phase 2	phase 3
pioneer plants stabilize bare soil and attract the first reptiles, insects, and amphibians	expanding shrub cover creates shelter and food for small mammals, insectivores, and ground-nesting birds	mature vegetation supports complex food webs with predators, nesting raptors, and long-term ecological stability

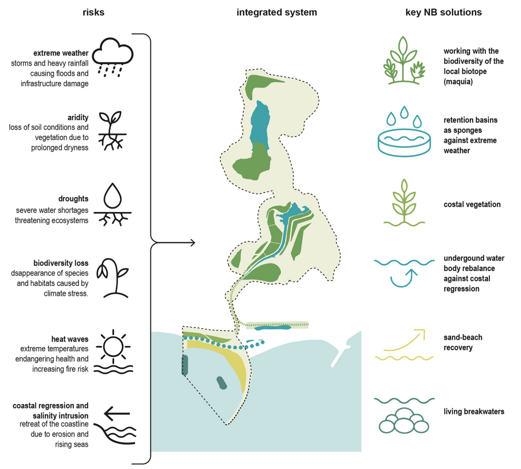
recovering the biological and hidrological continuity of the Fondo ravine


Santa Pola ridge
quarry
urban area C/Almeria
Varadero coastal system
maquia
runoff
continuity interruption
informal flow retention
paleochannel
continuity interruption
upper bench
lower bench
level change
sediment transport
designed flow retention
floodable park
dynamic water balance against costal regression
renaturation and water infiltration
runoff retention
level change
storm infiltration tanks
dune restoration
interdunal groundwater

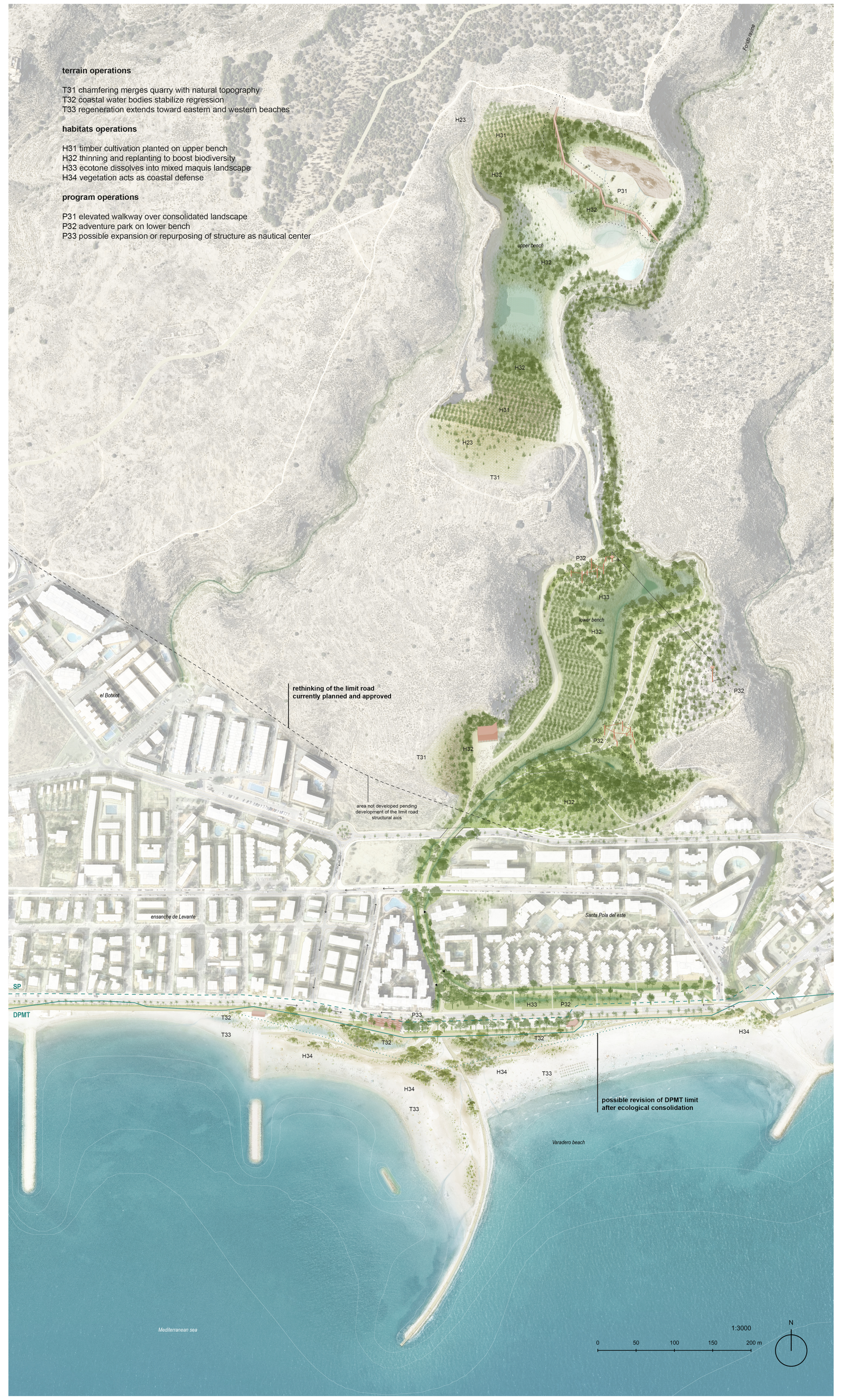
current state>>>
the Fondo ravine flow currently ends at the end of the quarry upper bench, interrupting a course that used to run down what today is C/Almeria before reaching the coast

>>>proposal over time
the proposal integrates the ravine as a multifunctional asset, guaranteeing continuity as water flows along designed retention basins that guarantee flood control. the ravine flows along C/Almeria as it once did ending its flow in the stormwater basins which allow costal water bodies to rebalance

nature based solutions for an uncertain climate future


risks
integrated system
key NB solutions

risks	key NB solutions
extreme weather storms and heavy rainfall causing floods and infrastructure damage	**working with the biodiversity of the local biotope (maquia)**
aridity loss of soil conditions and vegetation due to prolonged dryness	**retention basins as sponges against extreme weather**
droughts severe water shortages threatening ecosystems	**costal vegetation**
biodiversity loss dsappearance of species and habitats caused by climate stress.	**undergound water body rebalance against costal regression**
heat waves extreme temperatures endangering health and increasing fire risk	**sand-beach recovery**
coastal regression and salinity intrusion retreat of the coastline due to erosion and rising seas	**living breakwaters**



terrain operations

T31 chamfering merges quarry with natural topography
T32 coastal water bodies stabilize regression
T33 regeneration extends toward eastern and western beaches

habitats operations

H31 timber cultivation planted on upper bench
H32 thinning and replanting to boost biodiversity
H33 ecotone dissolves into mixed maquis landscape
H34 vegetation acts as coastal defense

program operations

P31 elevated walkway over consolidated landscape
P32 adventure park on lower bench
P33 possible expansion or repurposing of structure as nautical center

Fondo ravine
upper bench
lower bench
rethinking of the limit road currently planned and approved
area not developed pending development of the limit road structural axis
el Botxiot
ensanche de Levante
Santa Pola del este
SP
DPMT
possible revision of DPMT limit after ecological consolidation
Varadero beach
Mediterranean sea
1:3000
0
50
100
150
200 m
N