ANZIO, "PORT CITY" - AN INTEGRATE TERRITORIAL DEVELOPMENT PLAN

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Anzio is a city of about 65,000 inhabitants at 60 km south-east of Rome on the Tyrrhenian Sea. It's a city with an ancient history and that lived on its port. The first port was built at the time of Emperor Nerone and later in modern times has been rebuilt and enlarged by the Pontifical Government.

The Municipality of Anzio has formed the Company Capo d'Anzio Spa with the task of creating the new port by the rules of the new Port Master Plan. The intended uses in the harbour are: ro-pax ferries to Ponza and Sardinia islands - Luxury Cruises - deep sea fishing - boat marina for 1400 from 8.5 to 50 meters.

The draft was prepared by a fully public company to develop the whole city with an integrated approach.

ECONOMICS

Without using public funds the Municipality will execute the whole complex of works solely through the sale of rights of mooring berths and then from a financial point of view the novelty of the port of Anzio is given by the opportunity to build a port multifunction and restructure an entire city using only private money.

The project include a business plant that is funded through the commercialization of the various port functions. The entire funding necessary to provide for a total investment of 200 million euros that will be found on the market through the breakdown of assets in different financial needs. Besides selling the right to use the berths, as mentioned above, are expected the sales of commercial areas, shipyards, cruise terminal management, management of the parking system, a bunkering system, and the plant

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production of electricity from alternative sources. It is planned also the realization of a marine archaeological park that will be an additional source of income. Through tender procedures, according to European standards, a partner will carry out technical and financial investments in exchange for the marketing of various assets. In practice, the different components of environment and development of the project become sources of project funding.

ARCHAEOLOGY

One of these environmental components is localized archaeological park in front of the waterfront to the west where there are the submerged remains well-preserved ancient Roman port That will be retrieved and made visible by two walks to the sea cliffs of protection Placed on two. The Emperor Nero was born at Anzio and he made its port with the intention of returning his hometown to its pristine glory. Was chosen the area where the ancients Latins built the "Caenon", were identified as points of attack the two promontories where natural created two moles, respectively, 700 meters long and 850 meters east to the west. Both breakwaters were built around a basin of elliptical shape. Each pier, almost 10 meters wide, was built using cast of cement work. Highlights include the port facilities related to business-related and connected with the main highways. The remains, visible below the lookout Nero, are popularly known as the caves of Nero. Among these, a large tavern on the docks, a series of vaulted rooms, which will forward several meters into the hill and that probably they performed the functions of warehouses. With the execution of such work should take advantage of the existing buildings for economic purposes and archaeological preservation purposes, thus representing a further element of economic and environmental sustainability of the intervention in a broad sense.

STRUCTURAL CHOICES

Furthermore, the development of the project marine facilities have been designed with the intention to take the utmost account the boundary conditions in which the port is done, for example, emphasize two choices that were made:

- The first is motivated by the fact that the port of Anzio infrastructure is located very close to Rome, and much frequented by small pleasure boats and yachts, often engaged in international sports competitions. In fact, given to the small size of the sail boats in the immediate vicinity of the port it has-been designed with the help of a physical model realized by Maritime Hydraulic Laboratory of the University of L'Aquila in a particular cell body with reflection of waves and surf the wave dissipation system to minimize the formation of reflected waves and / or refracted in front of the breakwater. The cell body, prefabricated reinforced concrete, is ballasted on site with dry material and / or with non-reinforced concrete.

The width of the body and the number of cells along the cross section are determined by the extreme wave and are respectively equal to 8.0 m (B), and 2 of which 1 is antireflective, while its length, due primarily to the needs constructive (size of the platform) is equal to 13.00 m.

The depth of foundation of the body is equal to 7.0 m -

The thickness of external walls is 0.35 m and 0.35 m sea side port side, while that of the interior walls is 0.25 m.

The slab of the base is the most stressed structural part, in the operating phase, therefore the thickness must be adjusted and it is equal to 0.50 m. In addition to distribute over a larger area of ground forces exerted on the crate is necessary to enlarge the base slab with two swings in the direction of highest stress, and therefore the size of the plate are equal to 10.00 m in width and 13.00 in length.

The share of the breakwater is determined by the operation of the dock in situations of extreme wave and is equal to +6.20 m a.s.l.

To reduce the reflection of waves, the forces acting on the structure and erosion at the foot, the body has been equipped with rooms to absorb the energy related to the wave motion through various mechanisms such as hydrodynamic turbulence, the vorticity and resonance. For the analysis of the hydraulic response of drilled caissons (reflection coefficient, pressure, overflow, etc.), Reference was made to the consolidated Japanese formulations, the results of recent and advanced European experiences in the laboratory (2D and 3D), which on prototype, which was attended by the designers themselves, as indicated in the introduction. Some might also benefit the direct experience of similar work under similar conditions, in particular the new dam west of the industrial port of Porto Torres (having similar wave of project).

So that the rooms absorbent may have the effect it is necessary that the porosity of the wall on which acts the wave, defined as the ratio between the total area of the openings and the area of the whole wall is between 15 and 40%; the boxes in question have a porosity of 22%. On the basis of experimental data, the coefficient of reflection depends on the length of the cells and the wavelength of the incident wave and assumes the minimum in correspondence of B '/ L = 0.15 ÷ 0.20. The reflection coefficient can be estimated through the following expression:

where

B '= 3.5 m width of the cell

L = 113 m wave length of the project near the body (with Ts = 12 s)

Getting Cr = 0.77; a precaution was taken Cr = 0.8

The coefficient Cr = 0.8 is definitely precaution because no account is taken of the three-dimensionality and obliquity of the waves: in fact the different parts of the wall are struck by the wave at different times (time lag of pressure), but thanks aperture internal cell between cell and in the direction orthogonal to the wave, the water will tend to expand even on contiguous cells in which the wave motion still has not reached, dissipating a greater energy.

Is also observed that the choice of rectangular openings with a high wetted perimeter ensures a higher dissipation, compared to traditional circular openings especially with

the oblique waves, as shown by recent laboratory experiments. It 'still a need to provide the cells with appropriate air vents.

The structure must be checked at all stages of processing, especially in the phase of flotation, in the step of positioning without abutment and without breakwater and in the final phase of operation. Among the positioning of the container body and the realization of the final abutment will be able to pass a maximum of 2 years; of this fact has been taken into account in the dimensioning of the body by the action of the wave motion is not extreme.

- The second choice that is exposed is triggered by the fact that the reconstruction of the port city waterfront is made right at the centre of the city continuously inhabited and, therefore, to minimize the impacts of construction, was designed consisting of a quay LEGOSYSTEM made by small cassons antireflection prefabricated precast deck with above items.

So to accelerate as much as possible the realization of internal docks was designed prefabricated concrete blocks particularly easy and rapid development that minimizes impacts on the site of the city.

QUALITY OF INLAND WATERS

The new port will be realized in downtown; the quays are full of bars and restaurant with open space outdoor.

In order to verify the quality of water in the Harbour planned for the new port of Anzio we have evaluated the ability of water exchange with reference to decay of dissolved oxygen that occur in 5 days of cycles of tide.

To this end, the results related to the fields defined hydrodynamic with the series of simulations carried out using the model RMA2 were used to simulate the variation of the concentration of dissolved oxygen by using the calculation module RMA4 (from the suite of applications of the model SMS) the degree of solve the equation of dispersion/diffusion.

For the configuration of the project under examination was then possible, through the application of the model SMS with a time step of 30 minutes and on a total period of 120 hours of simulation, to study the temporal variations in the concentration of oxygen in the waters to ' internal docks.

The simulations were carried out by taking an initial concentration for all the mirror vaporize discrimination equal to 5.0 mg / l and a law of exponential type decay of [C (t) = C (to) e-kt] assuming as a decay coefficient value equal to k = 1.0. Furthermore it is imposed as boundary conditions that the water supplied by the pumps within the docks and along the domain border the sea side of the computational domain where there is concentration of dissolved oxygen equal to 7.0 mg / l. This choice is certainly conservative. In fact two openings along the harbour you can find values of dissolved oxygen concentration greater than those assumed on account of strong mixing brought about by waves and currents.

The results obtained for the configuration of the project, in the absence of pumping plant, have shown that in correspondence of the harbour Pamphili (in North harbour) and the dock vessels (in the inner part of the harbour South), are created areas of stagnation that determine a significant decay of the concentration of oxygen.

To overcome this problem has received a pumping system, sized and verified that water taken from the outside entering the docks, under the natural circulation improving the ability of parts of the system.

The simulations were carried out considering the contemporary drive of all the pumps for three hours a day both in conditions of flow is under the refluxing condition.

TRAFFIC

The reconstruction project of the port is completed by a large sector development viability access. In order to avoid increasing traffic in the centre of the city viable access to the port was moved to a new viability allowing the arrival at the dock from the north of the city without interference on secondary roads and urban tourism. For this reason therefore have been designed for direct interconnections with major roads of the roads leading to the capital. Again, to minimize impacts on the large archaeological fabric of the city, was designed a viaduct that passes over a major pre-Roman archaeological site located in the sanctuary of Santa Teresa is located in the hill at the entrance of the city.

From a technical point of view the project involves the modification and restructuring of the entire system of access roads to the city and the port and then the rebuilding of waterfront two places to the west and east of the existing port.

ELECTRICITY POWER PLANT

The port will have a production installation of photovoltaic panels and wind power mixed with an estimated annual production of about 650 MW / year. In particular we intend to use the wind turbine rotor axis of rotation vertical low-impact developed in Italy.

Having to compensate fully for the average power consumed by the loads, we have designed the system so as to obtain an annual average production truly remarkable. The physical limit for the design of this facility is to be represented by the collection available for the installation of photovoltaic panels.

From what has been achieved in the project and trying to take advantage of the terrace surfaces not to significantly impact the environment has seen fit to put these panels on the roofs of the shipyards.

The data used for the sizing of the system in order to maximize the energy collection of the panels according to standard CEI 82-25 are as follows.

Orientation of the panels: SOUTH

Inclination of the panels to the horizontal: 30°.

For the design of photovoltaic plant we have chosen the panels realized with mono crystalline silicon of the dimensions of 1700 mm in length and 700 mm wide developing a peak power of 150 W.

As indicated in the CEI 82-25, you need to file a second photovoltaic panels mutual distance which is a function primarily of the angle of inclination of the panels, namely:

d / h = sin (T) * tang (23.5 ° + L) + cos (T)

where:

d = distance between the panels

h = height of the panels

T = the angle of inclination of the panels to the horizontal

L = latitude of the area where the panels are installed.

With the panels we use the result is a mutual distance between the rows of 2.297 m.

It 'clear that the form factor of the panels slightly affect the disposal of the file. The end result, however, does not denote excessive variations, as if in front of a row of lower panels can be installed more files is also true that it decreases the collecting area of each row and therefore the electrical energy produced.

By placing these panels and thus optimizing the areas available n.1470 have installed photovoltaic panels with a total area of 1750 square meters of panels, developing a peak power of 220 kWp.

From Table 8.3 of IEC 82-25 gives the expected electricity production from the plant with an average yield of 75% is equal to 1300 kWh / kWp, which multiplied by the power of our system of 220 kWp provide us an annual average energy equal to 286,000 kWh per year of approximately 286 MW per year.

Small wind turbines

The use of small generation units to be located near the consumer is defined as: distributed generation. The system can be of the type stand-alone (totally independent, in that case must fully satisfy the energy needs of the consumer) or connected to the distribution network. In the latter case, which is what we have chosen, the system meets the needs of users but also contributes to the functionality of the same network.

Compared to the past, new technologies offer cost effective solutions for introduction into the existing electricity networks of small and medium-sized generators that use renewable sources or fossil fuels. The resulting reduction in voltage drop and losses pro-

duces, in fact, benefit the quality and performance of electricity networks. The distribution networks throughout the country generally have a configuration of the passive type, the power flow is always directed from the HV / MV substations to utilities: the introduction of the generators at the ends of the lines changes the active and reactive power flows, with repercussions therefore, the voltage levels and losses along the lines.

The voltage drop, in fact, depends in a linear manner from the flow of active and reactive power (and therefore, the addition of electric load, if other parameters are not changed, automatically causes a voltage value lower), while the losses along the lines depend on the square of the energy flows. The presence of a generator downstream of the existing power lines causes then:

- Energy savings due to reduced load on the network
- An improvement of the quality of the energy with the reduction of the voltage drop (currently many of the electrical devices on the market, complete with onboard electronics, are sensitive to variations in excess of 4%)
- An increase of the capacity of existing networks to support loads of active, reactive. Potential regional developments, the increase in energy demand can be managed not only with the increase of centralized production and the resulting power lines, but also with the possible coexistence between centralized and distributed generation.

For this project are used micro wind turbines with a nominal power of about 1000 W dimensioned so:

Available Length: 800 m
Pole Wheelbase: 25 m
Pole Number: 32
Power Rating (V to 9 m / s): 1000 W
Hourly output: 1000 W x 32 = 32 kW / h

The map of the winds produced by CESI in collaboration with the Department of Physics, University of Genoa in our area is estimated that the annual average wind speed is 5 m / s. From the data obtained in the field is that the average speed in Anzio is much higher than this value. This is because Anzio being situated on a point of cusp of where the arm will host the walk wind is the wind turbines will be built on the new breakwater located in the walk wind. Infacts the area is subjected to the constant winds prevailing daily from the west, beyond the strong winds generated by low pressure or changes in your meteor .

Considering, however, the minimum value quoted on the paper of the winds and whereas our post wind produces an average speed of 5 m / s the power of 300 W / h we obtain the following annual output:

300W/hx 32pali 8760h x = 84,096,000 W equal to about 84 MW per year.

Considering that the environmental impacts of small wind turbines is very minimal and that the so-called clean energy, which is obtained from renewable sources is a

sure goal that we will try to reach as soon as it is believed that a power like that is surely to be exploited.

For the Balance of the beaches were used the results of a physical model and two separate mathematical models for the study of the erosive effects of the new port. The results of the studies helped to identify and implement a storage area that will be used as a quarry to supply sand beaches of neighbouring municipalities also (Neptune, Ardea) with mechanical transfer.

Regarding the assessment of the impact of new works on adjacent beaches, has focused attention only to the stretch of coast between Anzio and Nettuno thereby assuming that the new harbour works may not have any impact on the shoreline in place immediately north of Anzio. The stretch of coastline under study was investigated by applying the method of Silvester and Hsu (1993) is particularly suitable for the analysis of "pocket beaches".

The method of Silvester and Hsu pointed out that, in the case where you do not envisage any intervention milder, the construction of new works breakwater would result in a rotation of the shore line counter-clockwise in the stretch of coast adjacent to the pier. This rotation would have the consequence of the advancement line of the shore in the stretch of coast adjacent to the port at the expense of the beach breakwater subject to a clear erosion.

To avoid that the width of the beach is reduced to values lower than the current ones, especially in correspondence of the roundabout foreseen in this plan, have been studied various hypotheses of intervention:

payment of a volume of sand of about 200,000 m 3 to compensate for the rotation of the shore line (Fig. 10).

the realization of a brush (length 150 m) in order to limit the rotation of the shoreline and beach nourishment (approximately 30,000 m3 of sand) of the stretch of beach east of the brush (Fig. 12 and 13).

construction of two brushes containing a length of about 70 m and beach nourishment (about 10,000 m3 of sand) in the stretch of coastline facing the traffic circle (fig. 13).

The method of Silvester and Hsu has allowed to identify the optimum solution, both from the morphological point of view that from the technical-economic. This solution is that which provides the realization of a nourishment and two brushes of containment. It is noted that this possibility of intervention is more economic than the other studied and minimizes the planimetric variations of the line of the shore than the current conformation.

Studio harbour silting of the mouth

The problem of sedimentation of the mouth port, was faced with two different methods which had as its objective the study of areas of erosion and sedimentation and quantitative estimation of sedimentation with the new configuration port.

Study of areas of erosion and sedimentation

With the first method of analysis one objective was to identify areas of erosion and sedimentation that are created due to the new harbour works. In particular with reference to this case is extremely important to identify in which areas the sand, placing in suspension and carried by the wave motion juncture, tends to deposit. In particular, the study carried out, by the application of a series of numerical models, has made it possible to compare the floor plan of the project with both the current situation with both the design solution identified in 1989 by Estramed S.p.A. who performed on behalf of the Region Lazio, an experimental study aimed at identifying solutions to reduce the phenomenon of silting of the mouth port.

The results obtained in the case of the current configuration are in agreement with the evolutionary tendency that actually occurs for which it has sedimentation entrance port at the head of the work of defence affecting the access channel to the port.

The results obtained in the case of the configuration studied by Estramed are in agreement with the results obtained on the physical model for which it has sedimentation mainly along the work of defence and to a lesser extent in correspondence of the head. Furthermore, the tendency to sedimentation is lower than that relating to the current configuration.

The results obtained in the case of the configuration proposed in this plan show a decrease of the sedimentation. The loose material settles along the work. Although the evolutionary tendency similar to that shown in the previous case, the sedimentation in correspondence of the head of the work is different from that which is realized in the other two cases. In fact, both in the current configuration that in the one proposed by the study by Estramed, the abrupt expansion of the plume at the head of the pier breakwater determines a sedimentation in the counter. Instead, in the case of the configuration proposed in this plan, the particular shape of the work external determines a progressive detachment of the plume the same avoiding the sudden expansion of the flow. Consequently, sedimentation at the head of the work developed in the longitudinal direction (parallel to the coastal current), tending to form a "flèche" and not interesting, if not partially, the access channel to the port.

Quantitative estimation of sedimentation with the new configuration port

The numerical model has allowed used to calculate the potential flow of the sediments as a function of conformation of the bottom, the characteristics of the wave motion (height, period and direction of the incident wave) and the grain size of the sediment. In particular, along a reference section, the model was intended for the determination of the distribution across the section for calculating the volume of sand that migrates annually from the area west of the harbour towards the entrance port.

Since the simulated solid transport potential and is not effective, the distribution of the solid flow rate has been considered in parametric form. In essence, it was considered for each computing node, the percentage ratio between the flow rate from

the combined solid off (0 and progressive depth of -20 m on s.l.) until the progressive test and the total calculated by adding all the values of the flow including solid between the depth of -20 m on s.l. and the head of the pier Innocenziano (depths -4 m a.s.l.).

The diagram allows us to interpret and quantify the action of the brush provided obstacle exerts on the flow of sediment. For realizing the brush will prevent the flow of the sediment in the range of depth between the head of the outer breakwater and the depth range -7 me reduce of about 40% of the volume of sand that annually passes through the reference section from west to east.

In conclusion we can say that the construction of breakwaters works under this project will reduce from the current situation of the average annual rate of sedimentation in proximity to the commercial port of at least 40%. The expected rate of sedimentation is not greater than 30,000 m3/year. Moreover, this sedimentation does not directly affect the access channel to the commercial port. Therefore, periodic maintenance will not cause interference with the use by ships and boats of the two docks.

LUXURY CRUISES

We have designed a berth for luxury cruise ships sailing that meets the modern standards of port security. In order therefore to increase the tourist offer and the financial attractiveness of the intervention was designed within the port area dedicated to ro-pax and cruise ships up to 180 meters. in length. The area is provided in particular a multi-storey car park to service both the fast ferries that cruise. Also included was a ferry terminal with control tower of maritime traffic in a port of this kind with two docks and a separate movement of commercial ships, ferries, cruise ships, fishing boats, pleasure boats and 1400 may have traffic problems especially in summer. Of particular importance is the orientation of the cruise berth that was positioned to facilitate the mooring of vessels including luxury sailing (star clippers etc.) in relation to prevailing winds. The terminal is also equipped with a security zone with all electronic control equipment for both passenger area.

SHIPYARDS

Anzio has a long tradition of shipyards for the construction of recreational motor and sail boats. Currently the shipyards are located in an area between the old harbour and the historic city centre with major limitations of both the production and easy maintenance of hulls. The design plans to build a new area for shipyards located in the new outer harbour with an encreasing large areas dedicated. In new areas, you can then reactivate the production of boats without causing discomfort to the environment both in terms of city noises in terms of dust as well as smells from the use of protective coatings of the hulls.

For the washing of the hulls and bilges of the area shipyards is equipped in particular of a plant for vacuum collection and disposal of sequent after adequate treatment of the water.

JOB SECURITY AND ORGANIZATION OF SITE

have been hypothesized a series of organizational measures for the site so that the entire city to continue to perform their civic activities and trade as normal during the entire duration of the work.

The entire project includes a site that has a big impact on the normal life of the city, to this end we have included a proposed building site significantly reduces the inconvenience to the public. The town of Anzio in project specifications detail has requested that during the course of the work the city should continue its normal life and commercial activities (schools, offices, shops etc) and the port, in particular, should continue its normal activities commercial (fishing, ferries etc), sports (sailing regatta), and individual business enterprises affected by the works in the port can continue to conduct its business without interruption. time schedule of Annex GANTT is shown how this was achieved.

SPORTS

A very important component of the project is the ability to manage and organize major sporting events at Anzio different types of boats. With the help of the Italian Sailing Federation's Local Committee has prepared a set of facilities to allow the holding of international events for sailing yachts Maxi, the monotypes bulb wheels, boats for young people (Laser, Optimist, etc. ..). In fact it is designed a special area dedicated to sports clubs which was also arranged a training centre of the sailing navy. The area is provided at the entrance of a parking space for the stop of the trailer both for the drifts that for vessels bulb. In the immediate vicinity of the car park there is a dock for the mooring of boats of coaches and the press. The area of the sailing clubs is completed the inner harbour mooring areas for boats and the sea side with a bulb and a forum for the public to allow view of the races of the smaller boats.

THE LIFE PROJECT

European Ports Policy represents a priority in Europe today. In fact, as indicated on the Communication of the Commission on European Ports Policy (COM/2007/0616), ports are the key to European cohesion. This Communication follows up and implements the recently adopted Communication on Integrated Maritime Policy (COM(2007)575).

European Community (EC), trough COM/2007/0616, focuses on many important matters, including environmental sustainability, showing the following challenges :

- a technological change, characterized by the development of cleaner port operations;
- the reduction of greenhouse gases and air quality problems;
- the necessity to establish a dialogue on port performances between stakeholders, with the city, the region, and, if necessary, with national and international actors.

On this basis, Capo d'Anzio Spa and Anzio Municipality submitted to EC the request for financial support to realize the project named "**European Ports Life Cycle Assessment (LCA)**" (project acronym: LCA4PORTS). The project concerns the development of a Life Cycle Assessment (LCA) model for the environmental management of European ports, following the Community environment legislation on port development. Anzio's port context is suitable to become the first application of this methodology.

The project has got European financial support through LIFE+ "Environment Policy & Governance": a financial tool, which focuses on environmental strategic approaches and gives guidelines that will lead the future development of European ports. The total project amount is 1.091.650,00 €, with a EC financial contribution of 485.300,00 € (44,45 %). The Project started on November 2011 and will be closed before December 2015.

In this context, LCA methodology instead of being structured on the three steps "production-distribution-consumption" (LCA methodology approach for common products), consists of a strategic approach during the phases of "construction-management-closing down", considering all the environmental aspects of the processes: water, greenhouse gases emission, wastes, energy consumption, urban green areas and others.

Major environmental aims of the LCA4PORTS project are:

- ensure minimization of environmental impacts during site construction stage;
- ensure minimization of environmental impacts during port management;
- ensure minimization of environmental impacts during closing down stage;
- adoption, from the design to the management stage, of a transparency policy, which includes stakeholders involvement, in order to define strategies and interventions.

LCA4PORTS objectives are in line with the EC Communications and Directive ones: the project shall provide technological solutions which define an operational scheme for sustainable port design, through the application of Life Cycle Assessment (LCA) methodology. The added value of the project consists of a complex integration with the latest research results in the field of port environmental management, including a detailed evaluation on environmental impact of construction activities.

The main purpose of the project is to define both an ecological approach to ports design and a methodology for port environmental impacts evaluation, through LCA, taking into account potential impacts of construction activities (to reduce them) and implementing an Environmental Management System (EMS), extended to port area activities. The EMS will be implemented referring to the best available technologies (Information Technology, energy-saving installations network, water management system of the port area, etc.).

The application of LCA methodology to ports and, most of all, the implementation of an EMS for port services is a way to promote environmental technologies, showing the advantages that result from their application.

LCA4PORTS is not an environmental study to reduce impacts on existing ports; the new Port of Anzio hasn't been realized yet. Construction activities will start after the

end of LCA4PORTS design actions, in order to apply this methodology to the final design phase.

Therefore, the project proposal includes design, planning and management actions, the coordination of these activities and some specific dissemination activities.

To achieve project goals through the described approach, **actions** will produce technical reports and guidelines; it is also necessary to share objectives, discuss methodologies, share project results, inform about management, control quality and timing.

A preliminary survey on best practices about sustainable port development, using an integrated strategic approach, will lead to the first scientific and technical reference document for the LCA approach of Port development (**Guidelines**).

Design choices regarding technological systems, will adopt solutions with high environmental protection standards, able to minimize environmental costs (high useful life, possible recovery and/or reuse of materials, low environmental impact of materials disposal, etc.).

Finally, through the Environmental Management System (EMS) implementation, the project lays foundations for an environmental control policy, which shall be conducted throughout the lifecycle of the port, from construction to divestment, managing day-to-day operations.

The project involves the **Environmental Management Plan** of port construction, in order to reduce the potential environmental impacts of this activity. So, the selection of goods and services focuses on reduction of environmental impacts, associated with production (construction stage) and material disposal (closing down stage). The project also includes sustainable procedures for construction management, according with UNI EN ISO 14001 standard criteria.

Energy saving actions will be defined according to European Directive 2010/31/UE on the energy performance of buildings and European GreenLight Programme. The port area will reach high energy-saving standards and will include "nearly zero-energy building" (with reference to European Directive 2010/31/UE). This will be possible through the use of renewable energy installations, such as photovoltaic systems, and small wind turbines, installing an air conditioning systems with high-efficiency heat pumps and centralized control system and using interior and exterior lighting systems with energy saving lamps (with centralized control system). The area will achieve at least 50% of energy-saving, compared to energy consumption of a traditional solution.

The **waste water management system and buildings rain-water recovery systems** will minimize water pollution and consumption. Project will focus on water-saving technology and on the implementation of a monitoring system for water consumption and wastewater production. A flow rate measurement system will be used to verify the achievement of environmental objectives, which is the first step for the implementation of port environmental management system, according to UNI EN ISO 14001 criteria (control of water resources management of the whole port area).

For what concerns the **waste management system**, low environmental impact solutions will result from waste reception and waste management plan, referring to Directive 2000/59/EC.

Re-use of building materials for port works involves a reduction of the mining activity, that constitutes a meaningful reduction of the environmental impact in terms of raw material consumption. The recycled inert waste materials have various origins and are characterized by very variable composition and different features, depending on the construction techniques, raw materials and the local building materials. Normally, this kind of waste is subjected to mechanical grinding to achieve particle sizes suitable for the uses required (especially for non-structural aggregates).

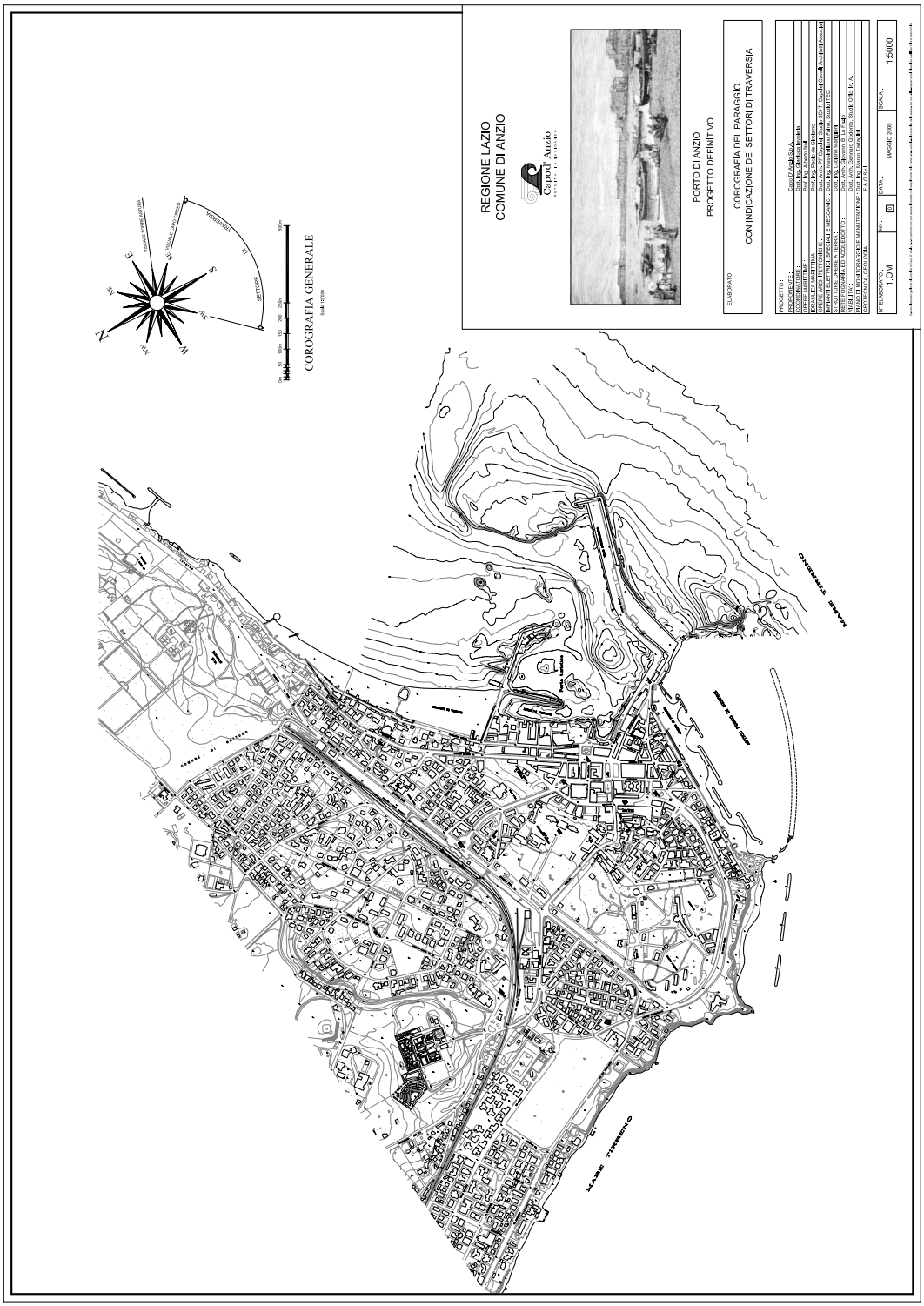
It is expected the total re-use of waste material in port constructions, except for buildings.

Finally, through the development of an urban **pilot project,** the area between the new port and the town of Anzio will be integrated in the project. The definition of environmental enhancement approach and urban development strategies, will identify urban interventions (public services, green areas, etc.) that are in compliance with the natural and urban context of Anzio. A participatory planning criteria will be applied to the whole design process, through the organisation of workshops and conferences.

The project includes **Communication activities**, such as designing and producing communication tools in order to inform about objectives, discuss about the applied methodology and share project results with European experts and Institutions. Communication tools and contents will be defined in relation to the target audience; communication channels will be used to optimize their efficiency, according to a Communication Plan; they will result from the analysis of economic and human resources available to realize this activity.

Some communication products, such as brochures and information panels for citizen and boat owners, will be useful to get suitable environmental targets in the port management phase. The defining of communications strategies and design will be leaded involving the national marine authorities, the port authorities and the environmental protection offices.

In addition, an European network will be organised, to diffuse project results and to collect a feedback from competent actors; it is expected to become an "ideas' laboratory", where experiences and informations can be exchanged.


REGIONE LAZIO
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PROGETTO:
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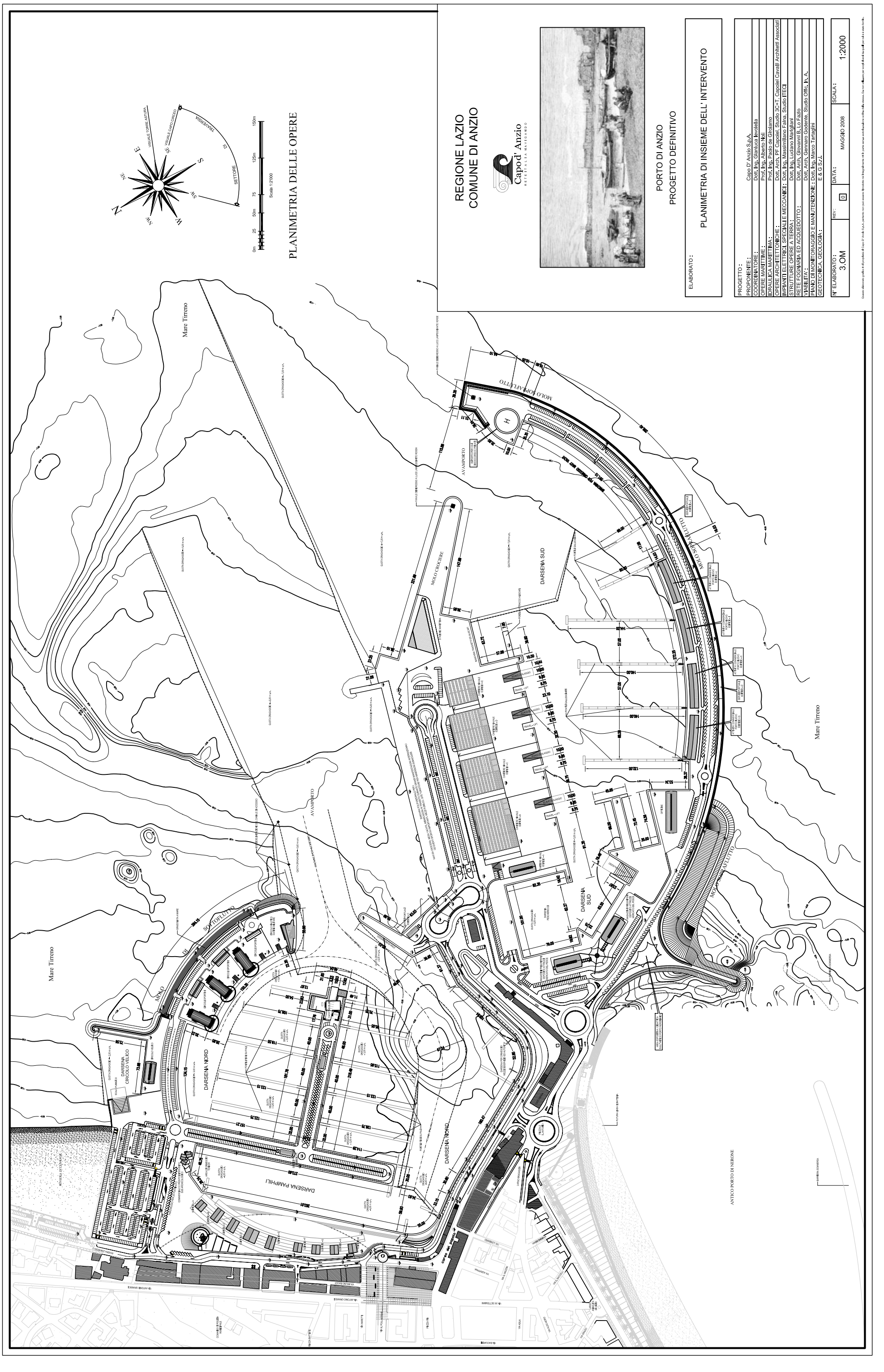
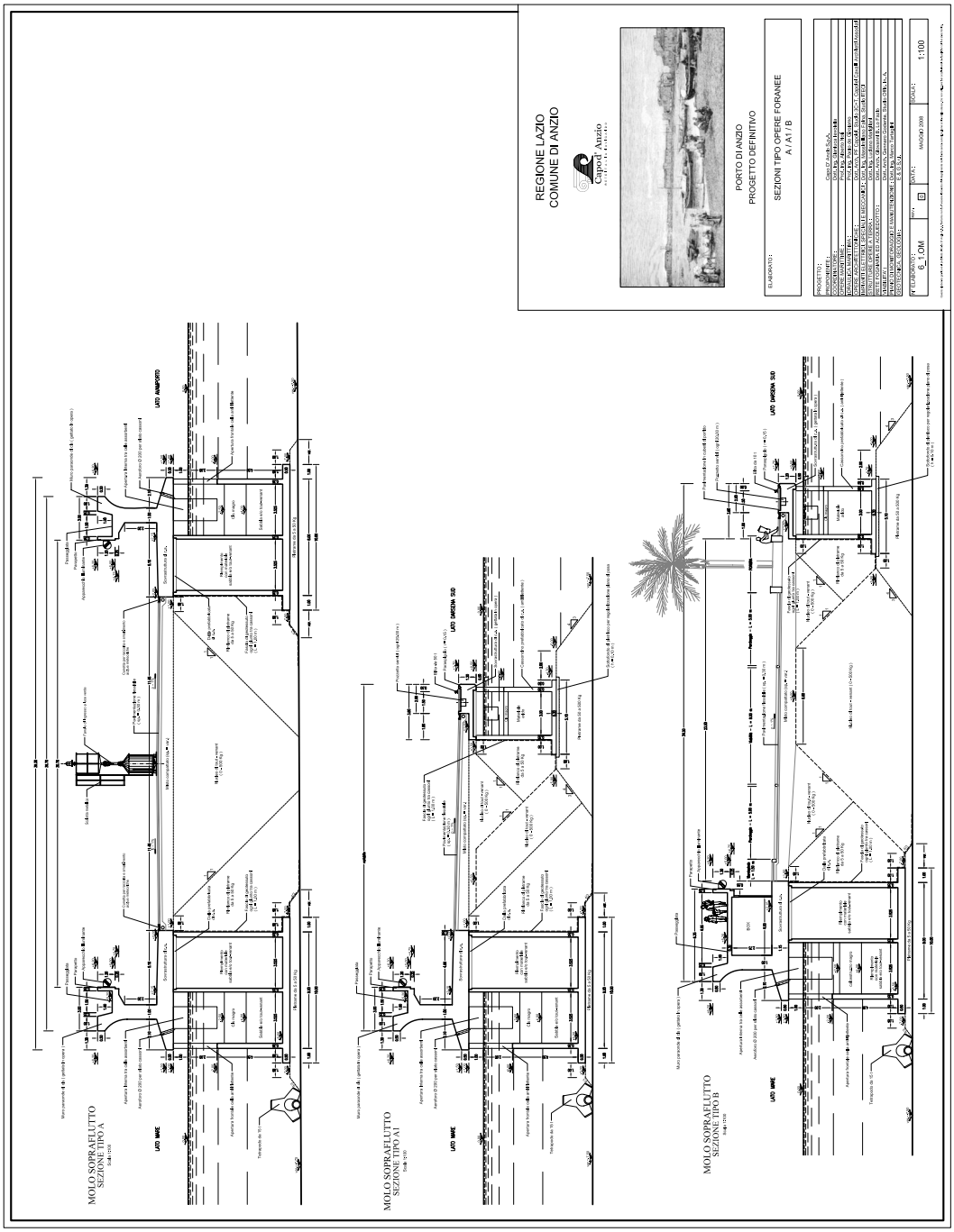
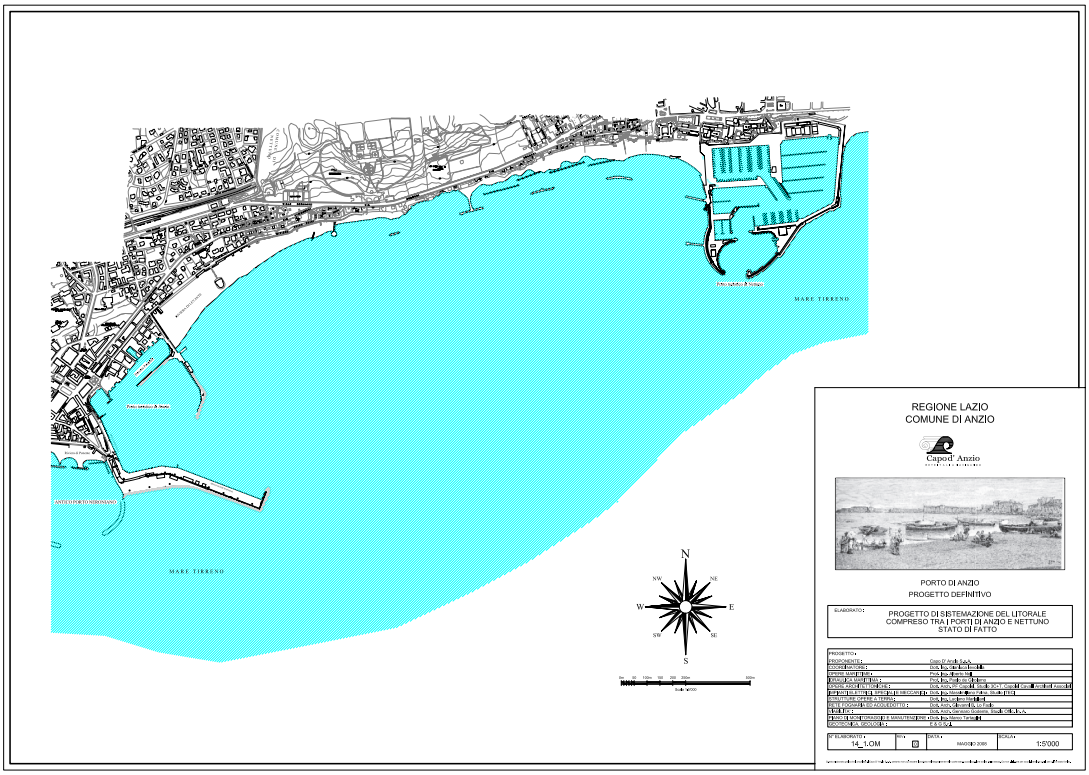
PROGETTAZIONE:
DIREZIONE LAVORI:
ESECUZIONE OPERE A TERRA:
ESECUZIONE OPERE A MARE:
ASSISTENZA:
PIANO DI MONITORAGGIO E MANUTENZIONE:
N° ELABORATO:
1.OM
DATA:
MAGGIO 2008
SCALA:
1:5000
COROGRAFIA GENERALE
SETTORE
MAR TIRRENO




REGIONE LAZIO
COMUNE DI ANZIO
Capod'Anzio
PORTO DI ANZIO
PROGETTO DEFINITIVO
SEZIONI TIPO OPERE FORANEE
A / A1 / B
ELABORATO:
6_1.OM
DATA: MAGGIO 2009
SCALA: 1:100
MOLO SOPRAFLUTTO
SEZIONE TIPO A
Scala 1:100
LATO ANTIPORTO
LATO MARE
MOLO SOPRAFLUTTO
SEZIONE TIPO A1
Scala 1:100
LATO DARSENA SUD
LATO MARE
MOLO SOPRAFLUTTO
SEZIONE TIPO B
Scala 1:100
LATO DARSENA SUD
LATO MARE


MARE TIRRENO
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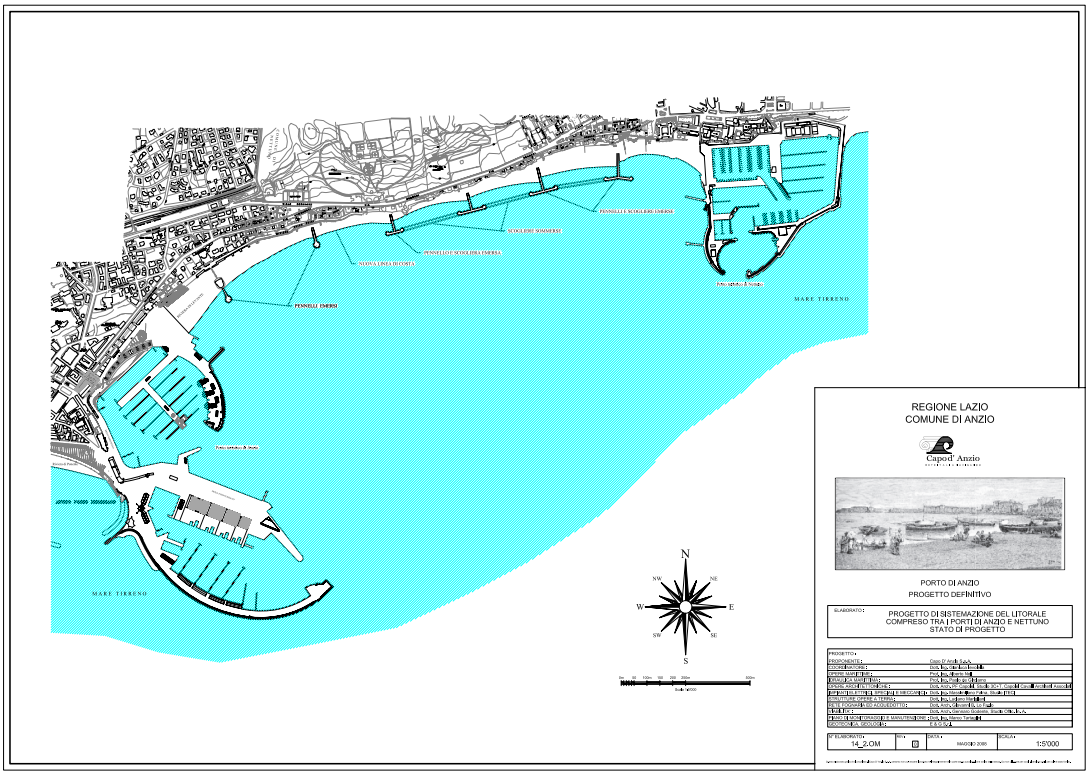
S
REGIONE LAZIO
COMUNE DI ANZIO
Capod' Anzio
PORTO DI ANZIO
PROGETTO DEFINITIVO
PROGETTO DI SISTEMAZIONE DEL LITORALE
COMPRESO TRA I PORTI DI ANZIO E NETTUNO
STATO DI FATTO
14_1.OM
1:5'000


PENNELLI EMERSI
MARE TIRRENO
N
NW
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SW
SE
S
REGIONE LAZIO
COMUNE DI ANZIO
Capod' Anzio
PORTO DI ANZIO
PROGETTO DEFINITIVO
PROGETTO DI SISTEMAZIONE DEL LITORALE
COMPRESO TRA I PORTI DI ANZIO E NETTUNO
STATO DI PROGETTO
14_2.OM
1:5'000