MODEL PROJECT FOR REHABILITATION, REFURBISHMENT AND ECOLOGICAL RECONSTRUCTION OF THE LANDS IN NAMOLOASA – MAXINENI RECLAIMED UNIT

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Abstract: *The prolonged droughts followed by floods, as result of climate changes, have a significant impact on agricultural production and on food safety. In such conditions, land reclamation works are vital, providing solutions for risks mitigation. In Romania, during the restructuring and reform process of agriculture, including the land reclamation sector, an important part of the existent infrastructure either couldn't be adapted and was abandoned or remained unused as inadequate to the new structures. In such circumstances, the land reclamation works need to be rehabilitated and modernize in order to improve their performances and to reduce the operation costs. The paper presents a model project for the rehabilitation and worth of the hydro-ameliorative facilities in the Low Siret Plain. The following activities were performed in the project frame: - estimation of the agro-productive potential of the climate, soil and water resources in the area; - inventory and analyze of the existent land reclamation works and their impact on the environment; - identification of the affected lands by different forms of degradation, risk evaluation and proposal of counteraction measures and ecological reconstruction. The methods and materials used were: soil maps, geo-morphological maps, analytic data regarding soil properties and groundwater chemistry, climatic data, on-site analysis. The research study is concluded with proposed works to be adopted, such as: - rehabilitation of the defense dams of the precinct, drainage networks, irrigation; systems and related pumping stations; - salted lands improvement; - area landscaping for specific crops to obtain renewable energy sources. The paper importance is found in the National Plan for Rural Development, Priority Axis 1, Measure 125 a – "Infrastructure improvement and development connected with agricultural development and adaptation", operational objective - Modernization and / or refurbishment of the irrigation systems and other land reclamation works. The project was performed in the frame of the Research – Development Sector Plan of the Ministry of Agriculture and Rural Development.*

Key words**:** *land reclamation works, rehabilitation measures, ecological reconstruction*

INTRODUCTION

In Romania, during the restructuring and reform process of agriculture, including the land reclamation sector, an important part of the existent infrastructure either couldn't be adapted and was abandoned or remained unused as inadequate to the new structures. In such circumstances, the land reclamation works need to be rehabilitated and modernize in order to improve their performances and to reduce the operation costs.

The paper refers to the researches carried out by I.N.C.D.I.F. – ISPIF in Namoloasa - Maxineni precinct, during 2006 – 2009, in the frame of the research and development project: "Rehabilitation and updating model project for the land reclamation and ecological reconstruction works of the lands in Danube Alluvial Plain and interior river plains in order to ensure their effective and sustainable use".

The project was carried out under the Research-Development Sector Plan of the Ministry of Agriculture and Rural Development, aiming to ensure the crops production in Namoloasa - Maxineni perimeter, to contribute to the floods defense in the area, to create the

environmental protection and to be a base for crops production as sources for renewable energy [1].

MATERIAL AND METHODS

Namoloasa – Maxineni – Racovita precint, having 57.244 hectares, is placed in the common alluvial plain of Siret, Buzau and Ramnicu Sarat Rivers, in four counties territory: Braila, Galati, Vrancea and Buzau.

The natural conditions of the area are the following:

- arid climate, with frequent drought periods in summer time and water excess in spring, determined by high variation of rainfalls and evapotranspiration consumptions. The annual average of rainfalls is of 450 mm, the multi-annual average temperature is of 10,5°C, the annual potential evapotranspiration is of 600 – 700 mm ; the average annual temperature of the growth is of 18°C . The absolute extreme temperatures vary between –26,4°C at Maicanesti(6.02.1954) and 44,5°C at Ramnicelu (10.08.1951).

- plane relief, with small slopes, under 1‰ and with depression areas representing some dead branches of Buzau and Ramnicu Sarat rivers. The lowest areas are around Olaneasca, Gulianca and Maxineni localities ;

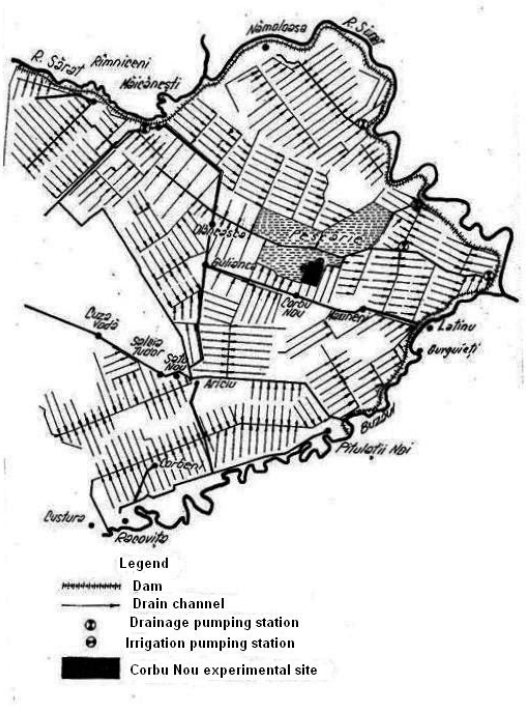

Figure 1: Namoloasa – Maxineni precinct

- the lithology is characterized by a superficial complex, low impervious formed from alluvial land and fine dust having 25-30 m thickness, laid on a sand and gravel depot very pervious of 10-12 m thickness.

- the ground water with permanent character is strongly mineralized (3-36 g/l salts) and saturates the sand and gravel depot till 0,5-6 m from the ground level. The ground water level stands in all points, showing that the embankment didn't influenced the hydrogeological regime of the precinct; the highest levels are found in Ramniceni-Gulianca-Maxineni depression; the runoff general direction of the groundwater is from the terrace to Siret, which is the only river draining the groundwater [2];

- water chemistry – the fix residue of the groundwater varies between 3 and 36g/l, so the water is strong mineralized, especially in the central area of Ramniceni-Gulianca-Ariciu. According the nearing to Siret river the mineralization degree of the groundwater decreases, being maintained at high values. Deep waters (100 – 120 m) have a mineralization between 0,97 – 1,06 g/l and brackish taste, being unsuitable for consumption. The pH values are between 7,71 – 8,08, framing in the exceptional limits allowed by STAS 1342/91, and the nitrates are missing [2].

- most of the soils are affected by glazing, salinization and alkalization processes. There are large areas with salted and alkaline soils [3].

The limitative factors of the area production are:

- drought climate ;
- groundwater and surface water, especially in depression and inter-grids areas ;
- soil salinization and alkalization in high the allowed limits for crops.

Aiming to increase these lands production, a series of worked were carried out in the area, consisting in:

- embankments 51 km
- drainages 57.200 ha
- dewatering 1.120 ha
- irrigations 41.500 ha
- fisheries 2.280 ha
- rice fields 1.380 ha

The water discharge is made using 3 pumping stations: SPE Maxineni (for 22.210 hectares, Q = 16,5 m^3/s), SPE Namoloasa (for 6.083 hectares, Q= 5,4 m^3/s) and SPE Maicanesti (for 5.229 ha, Q= 5,4 m^3/s)

Figure 2: Discharge pumping station in Maxineni

The irrigation system has 3 pumping stations: SPA Corbul Vechi, Q=4 m^3/s, SPA Namoloasa providing water for 22.328 ha, Q = 16,18 m^3/s and SPP 35 for 1.716 ha and are supplied from Buzau river.

The main crops in the area are (Table 1):

Table 1

The main crops

Crop	2005	2006	2007
Wheat (kg/ha)	2650	2850	2940
Corn (kg/ha)	4500	4000	6000
Sun flower (kg/ha)	800	1500	400

As regards the average productions obtained in the representative years, these were:

Table 2

The representative crop productions

Crop	Normal years	Drought years	Rainy years
Wheat (kg/ha)	2500	1500	4000
Corn (kg/ha)	3000-4000	1000-1200	5000-6000
Sun flower (kg/ha)	2000	800-900	1900-2000

The use of irrigation system led to a production increase since 2005. Thus in there were 300 irrigated hectares, in 2006 – 2500 irrigated hectares and in 2007 – 3100 irrigated hectares.

The land reclamation works were inventoried and they consist in:

- flood embankment on Siret, Buzau and Rm. Sarat rivers(defensing an area of 20780 ha). Namoloasa – Maxineni unit represents about 15.000 ha taken out from the entire flooding area of 57.000 ha. During 1958 – 1960 and unsinkable dam was built. The dam stars from Ramnicul Sarat (Maicanesti) and closes downstream from Latinu bridge (on Buzau river) having 40,5 km length. The crest elevation in natural regime are according to 2% protection degree. The features of the dam cross section are: crest width 2,5 – 3 m, inner slope 1/2 and outer slope 1/3;
- drainage works on 34837 ha. During 1975-1977 a drainage network was carried out having the distance between channels of 440-510 m. The channels dimensioning was done to have the water level with 40-60 cm below the ground level. The collecting pond surface is divided in 6 drainage systems and the water discharge is assured by 3 pumping stations;
- the area having dewatering systems is of 43615 ha. There are used surface discharge pipe networks for water excess and the area 12425 ha of un-salted soils, 16494 ha with low salinization with high groundwater level and 14700 ha of salinization soils.
- sprinkler irrigation systems on 41529 ha, 30640 ha in Braila County and 10889 ha in Vrancea County. The necessary water is supplied mainly by Siret River, but also from Buzau River, the fishery lake and from rice fields. The water is delivered by the aid of 3 pumping stations;
- fisheries on 1953 ha;
- experimental site, 105 ha (in Corbu Nou).

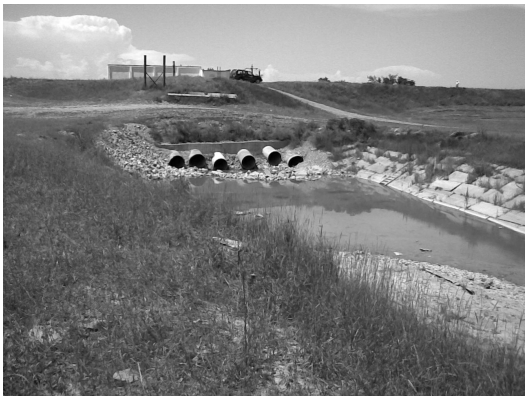

Figure 3 - Collecting pond

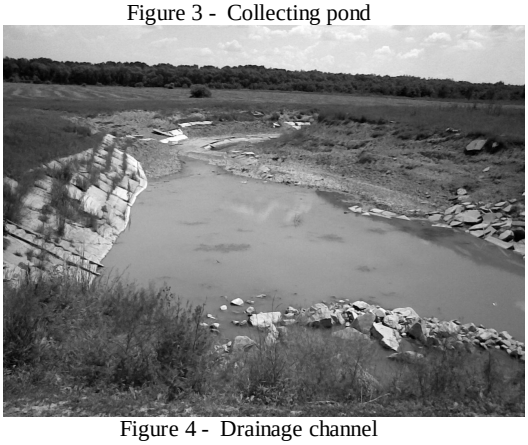

Figure 4 - Drainage channel

RESULTS AND DISCUSSIONS

The major deficiencies of the existent situation, with respect to the area development, have been settled and they are as follows [2]:

- the existence of some embankment sectors which are not safe enough in case of floods on the rivers in the area ;
- the increase of soil salinization process in the same time with the spreading of the phenomenon.
- the drainage works were effective, descending and stabilizing the groundwater level depths varying between 0 – 4,5 m in the impounded precinct or at lower levels even of 8 – 10 m, in the rest of the precinct to the high terrace. The drainage works functionality is quite poor due to the missing of the maintenance measures [1], [2].

Changes in the general structure of the land use were suggested, to correspond to the present situation of the soil degradation, the state of the land reclamation works and the new agricultural organization of the lands [1].

The following groups of effects, generated by the land reclamation works on the environment, were established [4]:

- effects generated by the change of the natural regime of the streams and rivers like alignments and embankments;

- effects generated by permanent/ non-permanent storage;
- effects generated by agricultural drainage (on ground and underground);
- effects generated by the use of irrigations.

Applying the matrix for the global estimation of the impact, the main effects observed are:

- over 60% of the effects are positive;
- the positive effects remain all over the operation period, emphasizing their importance.

The project suggests technical and economic scenarios to rehabilitate and refurbish the land reclamation works in Namoloasa-Maxineni-Racovita precinct, including the rehabilitation of the existent land reclamation work for agriculture, grouped in:

- medium term scenario, approaching:
  - the rehabilitation of the embankments in the precinct;
  - the rehabilitation of the discharge channels for surface water excess discharge;
  - the rehabilitation of the existent pumping stations and supplementing the water discharge capacities for rainy periods (program in development);
  - the rehabilitation of the facilities for rice crops and for fishery.
- long term scenario, approaching:
  - the rehabilitation of the irrigation systems and amelioration of the soils affected by salinization;
  - setting up of areas for specific crops for renewable energy obtaining.

In the frame of the necessary prefeasibility study, the following activities should be also perform additional pedological, geotechnical, hydrological and hydrogeological studies, for the whole precinct, delimited by Siret, Buzau, Ramnicul Sarat and Culmea Suligatu rivers consisting in :

- performance of new pedological and geotechnical bore holes;
- digging of hydrogeological pits outside the impounded area, (where there are 130 pits), their number and placement going to be settled depending on the depth of the groundwater;
- adding up of the hydrometric network on Siret, Buzau and Ramnicul Sarat rivers (interesting sectors) by providing new hydrometric posts;
- adding up of meteorological stations adequate equipped thus the climate factors to be registered and analyzed by 5-6 meteorological stations.

The investment costs (at 2008 year level) have been estimated for each type of necessary works, based on similar investments indicators, and are as follows:

a) flood defence works - 3.752.088 lei/ha
b) rehabilitation of the experimental site facilities - 10.250.300 lei/ha
c) rehabilitation of the discharge systems for excess water on land of the precinct by pumping it in the neighborhood - 7.516.461 lei/ha
d) fisheries rehabilitation - 8.752.300 lei/ha
e) reabilitarea amenajarilor pentru cultura orezului; 7.429.139 lei/ha
f) rehabilitation of the irrigation systems and flushing of the soil affected by salinization - 14.575.139 lei/ha

The total investment is going to be finalized in the frame of the feasibility study.

CONCLUSIONS

The main goal of the project was to achieve models for the rehabilitation, refurbishment and ecological reconstruction of the reclaimed lands, having two representative

precincts: one in the Danube Alluvial Plain and the second in Namoloasa - Maxineni – Low Siret Alluvial Plain, both of them being affected by floods 2005 – 2006.

The research and development project aimed to offer rehabilitation and refurbishment solutions for:

- embankments;
- land reclamation works like irrigation systems and drainage dewatering systems;
- land ecological reconstruction by territorial redistribution of different land use categories, depending on their yielding and reliability and on the economic and social opportunity.

The researches have been orientated on:

- settlement of measures, solutions, methods, new techniques and technologies for land reclamation works rehabilitation;
- settlement of technical, economic and social indicators;
- settlement of priorities

Thus, by extrapolation, all these results can be applied to other precincts.

The proposed solutions, techniques, measures etc. substantiated on "on site" and laboratory researches will be used for investment projects which are going to be developed for other representative precincts in the following years.

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