REPORT

on

RECLAMATION OF AMERICAN BASIN,

SACRAMENTO AND SUTTER COUNTIES,

CALIFORNIA.

by

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of

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San Francisco, Cal.,

Sept. 24, 1907.

RECLAMATION OF AMERICAN BASIN.

The scheme of reclamation proposed includes -

1. Protection by levees.
2. Drainage system to pumps.
3. Pumping plant.
4. Roads through district.
5. Irrigation.

For convenience of estimates and discussions, the levees proposed will be called the River Levee and the East Levee.

The River Levee is located on the present bank, and is to be built by dredges from river material, largely sand. Part of the district already has some river levee, much of which is available, but some will have to be abandoned.

It is not intended to abandon any of the present levee where it can be economically extended and maintained. Maintenance of a scraped levee becomes more and more expensive as height increases and material grows scarce, so that each part has been studied with future maintenance in view. Some good levee would better be abandoned now than raised now and have to be abandoned in a few years.

There is nothing new or peculiar about this levee. It is the ordinary river levee somewhat higher and wider than usual. The extra height and width are only an insurance (at reasonable cost) against breaks. They also insure decreased maintenance charges.

In case the State and Government go ahead with dredging the river below, this levee may never have to be raised. If this deepening restores the Sacramento to its "Conditions of 1850," the levee will seem absurdly high. Present conditions and doubt as to what the State and Government may do, however, warrant this height to-day.

The continued safety of any district in this delta depends on its being stronger than its neighbor. Grand Island is safe because when threatened, its neighbors' levees give way at crest of flood and gives it relief at a critical moment.

This has been so in the past and is true to-day, which would argue that levees must continue to be raised for safety. But there is another factor coming in. As levees are made to hold, the flood plain is raised, but the hydraulic slope, velocity and scouring are also increased. At some point, a balance will be reached, so that the avalanche of sediment started down from the Sierras is passed along as it comes.

The cessation of hydraulic mining is lessening the supply of debris. The increased velocity in getting rid of more of it. The Government and State may do something below, so that a condition of stability may be reached after awhile.

This report and estimate are based on an elevation at the North end (see map) of 50 feet, and at the South end of 40 feet, Western Pacific datum. (When these levels were started, it was supposed that sea level datum plane of average low water was used, but Bench Marks discovered en route indicate some discrepancies. From some checks made in the field, and information from the Weather Bureau and local Engineers, our datum plane is the lowest used. State Engineers Department use one 1'.74 higher, U.S. Engineer Dept. use one 3'.85 higher, U.S. Coast and Geodetic Survey use one 3'.94 higher; Sacramento City and the Weather Bureau use one 5'.59 higher, the U.S. Geological Survey use one 6'.09 higher.) This is approximately four feet above the flood height of 1907, the highest ever known. Slopes on the water side are 2-1/2 horizontal to 1 vertical; on the land side 1-1/2 horizontal to 1 vertical; width on top 20 ft. The length of the levee is approximately 36 miles, the South end being reckoned at Bannon Slough.

This levee contains approximately 5,000,000 cubic yards. At the outside, not more than 600,000 of this would be scraped to raise and reinforce present levees. The rest would be dredged material. At 15 ¢ and 7 ¢ per cubic yard respectively, this would cost $358,000. It is considered that the clearing will pay for itself and the price should add some protection by willow planting.

The East Levee is a protection against back water of the American River, into which flows a large volume of hill drainage through various streams from Coon Creek to Arcade Creek. Into this also flows water from Bear River through occasional breaks. Last Spring's water came across the country from Yuba River. This chance will be minimized by the California Midland road, which is to be built on the South levee of the Yuba. For safety against such overflow, however, it is advisable to raise the East levee at the North end, so as to handle a large volume of water between it and the hills.

This report and estimate are based on a levee height at the North end of 44 feet; at the South end of 40 feet, slope and width same as the River levee. The length is approximately 21 miles, the North and South ends being same as the River levee.

The location of this levee (where legal or other difficulties do not prevent) should be far enough West of the high land to leave ample water-way, yet not so far as to leave open stretches for wave action. The accompanying map shows it approximately. It was thought at first that section and quarter lines could be largely followed. Computations show that this is not economical, so the actual location will be a more sinuous line than is shown, though this projection is sufficient for the present purpose.

At the North end, the location is made the South line of Levee District No. 2 and the East line of Levee District

No. 6. At the South end, the location is made West of the road along the Haggin grant. The South line runs Easterly and Westerly an the North line of the River highway to Bannon Slough, giving the waters of the basin the same outlet they have always had at ordinary stages, whether inside or outside the projected levees.

Three grade lines have been projected; the top of the levee, El. 44 at North and to El. 40 at South end; the bottom of main drainage 12 ft. below this, leaving a water-way 100 ft. wide at this elevation, to care for receiving floods quickly; a sub-grade varying according to profile, but enough below the second grade line to drain all swales and low places.

So far as adjacent property on the East is affected, at flood heights there will be no change in the flood line. As the floods recede, the water will fall quicker because there is less quantity and a larger channel proportionately. The only time when lands to the East will be adversely affected will be when a flood volume from the side streams occurs at low water of the American. Then the low swales will be flooded a short while, not long enough to kill ordinary crops. It would really be but an irrigation and such lands would be benefited, not hurt.

The East Levee will contain 3,080,000 cu. yds. of material, 1,340,000 cu. yds. of which will be put in with an ordinary dredge at a cost of about 7 cents. The rest will be scraper work at a cost of about 15 cents, the total cost being

$354,800. One open stretch of two miles, on sections 7 and 18, Twp. 9 N., R. 5 E., will need some willow and Bermuda grass protection. This stretch contains the highest levee of the district and the greatest open stretch for wind and wave action.

Drainage should be by tiling, discharging into ditches, these in turn into two main ditches, one on either side of some comparatively high ground in the middle of the district (see contours on map), these two main ditches coming together about the head of Bannon Slough, which should be widened and deepened to the pumps at the levee.

All of the ditches should be shallow and have flat slopes, getting capacity by width. Deep ditches are hard to maintain, are apt to develop an extra quantity of water by reaching free flowing gravel strata, and are dangerous to stock. The final ditch reaching the pumps should be not less than 100 ft. wide.

The necessary depth and width of ditches is matter for development as the work progresses. The main ditches should follow swales, the laterals can generally be made to follow legal sub-divisions of land. The tiling can be put in according to porosity of soil and area.

Plans and estimates can only be tentative now, but the accompanying figures are considered as a fair estimate of probabilities;

Opening Bannon Slough,	1-1/2	miles	at	$26,400---	$ 39,600.00
Main Ditch North,	4	"	"	5,250---	21,000.00
Extension,	14	"	"	4,000---	56,000.00
Side ditches,	50	"	"	900---	45,000.00
Main Ditch West,	3	"	"	8,800---	26,400.00
Extension,	5	"	"	4,000---	20,000.00
Side ditches,	10	"	"	900---	9,000.00
					$217,000.00
Tiling, 30,000 acres,			"	4---	120,000.00
					$337,000.00

Ditches are a necessary part of the general reclamation. They must be of large capacity to get the water to the pumps quickly. Mistakes are frequent of having too small ditches, so that pumps have to shut down to wait for water.

The Pumping Plant is estimated as a steam plant with fuel oil. This is the best to-day, local fuel conditions, reliability, cost, operation and maintenance, all considered. Transmitted electric power or internal combustion engines are alternatives. The pumps, in any event, will be centrifugal pumps of large capacity.

The maximum quantity of water is estimated at 550 cu. ft. per second. This seems large, but there is no way of estimating the seepage prior to the event. The maximum seepage occurs at flood of rivers with a possibility of maximum rainfall coincident therewith, so the maximum quantity of water may

have to be handled with the maximum lift, say 35 ft. At 60% efficiency, the indicated horse power would be 2600. At $80 per horse power, which includes cost, installation, housing and fuel storage, this would amount to $208,000.

Roads through the district are a necessity. Main highways should be macadamized so as to be available at all times. Muddy and rutty roads are expensive to the farmer. They lessen the load he can haul, they wear out his team and his temper.

There should be a main highway Northerly and Southerly through the district, say about the middle, and side roads reaching all parts of it. The estimate would be about as follows:

Main Highway,	Grading,	20 miles at	$750—	$15,000.00
	Macadamizing,	20 " "	$2500—	50,000.00
Side roads,	Grading,	100 " "	$200—	20,000.00
	Gravelling,	100 " "	$800—	80,000.00
				$165,000.00

Irrigation is not necessary to raise crops in this district, but will largely increase the yield and is, therefore, profitable.

The low-lying lands, say 50,000 acres, are easily and effectively sub-irrigated by damming up the drainage. The cheapest and safest way to irrigate the remaining 20,000 acres is by pumping from the drainage ditches or wells.

As the land to be irrigated by pumping is very scattered (a fringe around the district and some high land in the middle), no single system is practicable to cover it. It will naturally be done in districts.

Power for irrigation by pumps can be generated by the boilers and engines of the main pumping plant, since irrigation would only be done during the low duty season of the drainage pumps. This, transmitted over the district, could be available for pumping and many other purposes.

An approximate estimate of this cost would be --

3 - 250 K.W. generator units, with exciters, transformers, etc., cost at $6250	$18,750.	
Installation, say	3,750.	$22,500.
2 - 25 mile pole and wire lines #4 copper, 50 miles at $1300	$60,000.	
Installation and connections	10,000.	$70,000.
50 - 35 H.P. motors, 50 motors at $1220	$61,000.	
Housing	10,000.	
Installation, say	5,000.	76,000.
Irrigation, water supply and distribution, Sumps, 75 at $200	$ 5,000.	
30 miles ditches at $150	4,500.	9,500.
		$178,000.

The District is best shown by the accompanying map.

Total acreage ---------- 59,520 A.

Right of way, levees and borrow pits	1104	
Ditches	1300	
Waste land, say	896	3,800
Land reclaimed		55,720 A.
In District No. 6		5,720
Outside District No. 6		50,000 A.

These acreages are approximate. District No. 6 is included for economic reasons. A deal should be made with them or their boundary extended to include this basin, or something of the kind. Their land naturally belongs to the area to be reclaimed. As their lands were flooded last spring, possibly such a deal could be easily made now. Good protection and complete reclamation is worth all it will cost them.

The Soils of the district are good. There are a few streaks of hardpan near the Eastern boundary, the total area of which is insignificant. It occurs where the waves of the basin at flood times have denuded the slopes of soil down to the hardpan.

There is no evidence of alkali in quantity. Reclamation will materially eradicate what little there is. On the other hand, careless farming, allowing water to stand and evaporate from the land, will develop it. There is a salt grass in spots, that argues alkali, but in no case is it concentrated in hurtful quantity.

There is a fringe of high land on the East side, now known as wheat land, that is probably the best vine land in the district. It contains about 5000 acres.

The greater part of the land is a sedimentary loam, more or less sandy, of evident great fertility. Its fertility is quite evident on inspection, but can also be understood by the fact that it has been annually, sometimes twice annually, flooded by heavily silt-laden streams for many years. It is

fitted for alfalfa, grain, hops, berries, vegetables, deciduous fruits, figs, nuts and vines. It will produce anything suited to this climate. Samples of apples and citrus fruits are raised on the River fringe of the district, though not in greatest perfection.

There are two or three thousand acres of tule lands, the reclamation of which will make the most productive vegetable land of the district. Reclamation of similar lands further South makes the asparagus lands of the Island district the highest priced farm lands of California.

Only on the River fringe of the district is any farming done now. The land is flooded each year. The season is short, varying with the elevation, longest at the river, because highest. There is sometimes a June flood in addition to a winter flood. All of which makes farming precarious, so most of the land is given up to sheep grazing after the floods recede.

Despite this, there are now growing good crops of potatoes, beans, corn, alfalfa and melons. Some orchards are doing well, but lack of attention argues general discouragement. With reclamation an enormous output of fruit, vegetables, grain and hay is possible.

Transportation is good and improving. The River is navigable along the whole West side. The Northern Electric road is in operation just East and parallel with the East side. The Western Pacific parallels the East side and will be in

operation before the reclamation can be completed. Sacramento is only two miles from the Southeast corner of the district, with the Southern Pacific net-work of railroads reaching all parts of the State and the East. The Santa Fe is at Stockton and Antioch, with steamers on the rivers. In short, this district has all the transportation there is or likely to be. It is hardly probable that any railroad will ever enter Northern California without reaching Sacramento.

Markets are very available, with the good transportation. Sacramento is a large and growing City, two miles away and reached by boat and rail from all parts of the district, or with a wagon haul. San Francisco is 100 miles away, reached by the Southern Pacific three lines; river boats; soon to be reached by the Western Pacific and the Northern Electric. All parts of the State are reached directly by the Southern Pacific branches and connections. The East is now reached by the Southern Pacific and Santa Fe, and soon to be reached by the Western Pacific.

The acreage and productiveness will demand packing houses and canneries on the ground. These and warehouses should be established with relation to transportation and the needs of the district. The Northern Electric and Western Pacific could easily reach such established points. The Southern Pacific could do so not so cheaply, but would when business warranted. Without attempting to decide such locations, it would seem that about these points would be necessary -

say the mouth of Bannon Slough, a point on the river at or near Vernon, and a point east of Vernon, about the junction of the Northern Electric and Western Pacific.

Time for completion should be three years. Farming could begin safely the second year. The first year, the river levee could be built and the East levee in protected spots. The second year should see the levees completed and the pumping plant installed. The third year the drainage and roads could be finished.

The plant required would be about as follows:

1st. Four dredges of 1600 cubic yards capacity, booms about 120 ft. long. One of these should be purchased, the rest hired or work contracted to outside dredges. The first cost of such a dredge is about $40,000.

2nd. One hundred four-horse teams with Fresno scrapers and plows. These could not all work the first year, but the second year their presence would be imperative. Probably this scraping could be contracted to advantage. There are many large scraper outfits on the Northern Electric and Western Pacific now.

3rd. Ditching machine, steam shovel type, on a barge, costing about $15,000.

ESTIMATE COST.

Rights of way, Levee 1100 A. at $30,	$33,000.		
Ditches1100 A. " 20,	20,000.		
Roads, 800 A. " 10,	8,000.	$ 61,000.	
Protection, River Levee	258,000.		
East Levee	354,800.	613,800.	
Drainage, Ditches	217,000.		
Tiling	120,000.	337,000.	
Pumping Plant,		208,000.	
Roads and Bridges,		200,000.	
Irrigation Plant,		178,000.	
Engineering and legal expenses 5%) Accidents and Incidents - - - 5%)		160,000.	
TOTAL - - - - - - - - - - -		-$ 1,756,800.	

Or $31.53 per acre for net acreage reclaimed.

HUNT, DILLMAN, MEREDITH & ALLEN, Inc.

ENGINEERS.

San Francisco, Cal., Oct. 1, 1907.

Mr. R. G. Hanford,

Folsom, Cal.

Dear Sir,-

The Engineering Report on Reclamation of American Basin made you recently is, as such reports should be, a cold statement of facts, with no enthusiasm.

But the subject deserves enthusiasm. The land is so good that it will appeal to the expert farmer at once. It is as rich as Illinois swamp land, with the advantage of a kinder climate and generally closer market. The scheme of reclamation is simple, cheap to execute, cheap and safe to operate and cheap to maintain. I have examined many tracts of land in California and elsewhere, reclaimed some, been connected with the reclamation of others, own lands in California and elsewhere, but have never seen as large a single tract of land of equal richness or less waste. It is larger by far than any single tract of overflow land yet reclaimed in California.

All things considered, simplicity, quality of land, proximity to market, climate conditions, first cost, operation and maintenance, this is the finest reclamation project yet considered in California, and is sure to result in large profits to the investors who will carry through the plans as outlined in the report.

Very truly yours,
(Signed) Geo. L. Dillman.

GLD.

GEO. L. DILLMAN
Engineer.

San Francisco, Jan. 9, 1909.

Mr. R. G. Hanford,

Alaska Commercial Bldg., City.

Dear Sir:-

Replying to yours of yesterday.

The East levee has a maximum height of 20 ft., an average height of 12 ft.

The River levee has a maximum height of 17 ft., and an average height of 11 ft.

Both levees have a width on top of 20 ft., slopes 1-1/2 to 1 and 2-1/2 to 1, making the bottom width vary from 52 ft. for an 8 ft. levee to 100 ft. for a 20 ft. levee.

The 20 foot width is sufficient for a roadway and will allow easy passing of vehicles.

Very truly yours,

(signed) GEO. L. DILLMAN

HUNT, DILLMAN, MEREDITH & ALLEN, Inc.

ENGINEERS

San Francisco, Cal.

Oct. 3, 1907.

Mr. R. G. Hanford,

Folsom, Cal.

Dear Sir:-

Herewith please find map of proposed American Basin Reclamation District, with somewhat detailed report and estimates.

The project is perfectly feasible. Though a very large district, it is compact and plans proposed for its reclamation introduce no new features. Higher levees are maintained on Grand Island.

The cost, compared with the value of the reclaimed land, leaves a large margin for profit. The only chance for loss is in mismanagement, spending the money and not accomplishing the reclamation.

Very truly yours,

GLD. (signed) GEO. L. DILLMAN.