

FLOOD CONTROL  
DISTRICT OF  
MARICOPA COUNTY

UPPER NEW RIVER  
FLOOD MITIGATION  
FEASIBILITY  
STUDY



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**UPPER NEW RIVER  
FLOOD MITIGATION  
FEASIBILITY  
STUDY**

## UPPER NEW RIVER FLOOD MITIGATION - FEASIBILITY

### PURPOSE

Residents that live along the banks of New River north of New River Road, experienced flooding from the rains of January, 1993. The runoff in the river was estimated to be 25,000 cubic feet per second or approximately the 50-year event. The flows overtopped the low-flow banks and traveled south down 16th Avenue, a dirt roadway, approximately three-quarters of a mile until they rejoined the main channel; these flows caused significant erosion, lowering (scouring) the roadway from one to three feet along its length. 16th Avenue was impassable during this event. The flows trapped residents in their homes and cut off access to the residences.

36th

36th

### INTRODUCTION

Many residences along the upper reach of New River (north of New River Road, upstream of I-17) were flooded in January, 1993; the river flows overtopped the east bank of the low flow channel. The interior of one house was flooded and access to 26 other houses was cut off for over a day. The meandering river caused the channel to erode laterally at two locations along this reach (see attached maps). The Soil Conservation Service (SCS), together with the Flood Control District of Maricopa County (District) and the Maricopa County Department of Transportation (MCDOT), restored the low flow channel bank to its pre-flood configuration at two locations (see attached photos). Also, two 36" corrugated metal pipes were installed in New River at Kelly Road to handle nuisance flows.

Residents of the upper New River area recently posed the question, what can be done to safeguard our residences against major flood events, such as the 100-year flow? Staff from the District have evaluated several options to mitigate the flood problem. The results of the evaluation are contained in the following report.

### BACKGROUND

The upper New River area, above New River Dam, is an area of relatively pristine riverine environment and lush vegetation. Water flows in the river approximately 10 months of the year. Indeed, it is the relative abundance of water in the desert which attracted a stage coach stop to be sited in the area during the Arizona Territorial days and attracted people to the area in the recent past. People have constructed their homes under the vegetative canopy that grows along the banks to escape the harsh desert sunlight.

During the summer of 1972, flood flows in New River destroyed two County Highway bridges, which had to be replaced. The I-17 bridges over New River pass the 100-year flow, but not before it overtops its banks.

As part of an ongoing program, the District delineated the 100 year floodplain of New River from the reservoir pool of New River Dam upstream to Table Mesa Road, in 1989. The entire reach of New River from Table Mesa Road to the I-17 bridge was designated "Floodway," due to the depth of the water (11 feet) and the high velocities (18-22 feet per second); these conditions are very destructive. While it is possible to engineer structures to safeguard against such conditions, it is prohibitively expensive. Therefore, development in such an area is generally discouraged. "Floodway," in the terminology of the National Flood Insurance Program, is a "no-build zone."

#### PROBLEM

At present, there are 27 houses in the designated floodway. Residents of these houses did not have access in and out in January, 1993 during a flood of less than the 100-year magnitude. What options are available to safeguard these houses?

The houses in the area were constructed before the floodplain delineation in 1989 and before the District's drainage ordinance was enacted in 1972. Therefore, there was no data to alert people to the dangers of building near the river channel and no regulatory tools to constrain people from building in the floodway.

#### ALTERNATE SOLUTIONS

The District has investigated four alternative solutions:

1. No action.
2. Construction of levees to separate the houses from the water.
3. Construction of a dam upstream of the houses to retard the floodwaters.
4. Buy-out of all of the houses in the floodway.

These four alternatives will be described in detail.

#### **Alternative #1: No Action.**

This alternative is to maintain the status quo.

## **Alternative #2: Construct levees.**

A method to safeguard the houses from flood waters is to construct a levee to isolate the water from the houses. The levee would need to begin upstream of the houses (see attached maps) and extend downstream past the residences.

Under natural conditions, the 100-year discharge is 35,000 cubic feet per second flowing 11 feet deep at 18-22 feet per second. The flow is in the supercritical regime. The levees would reduce the cross sectional area of the channel by up to 50% which will exacerbate the hydraulic conditions; the velocity and the depth of flow would increase.

Therefore, the river must be confined until there is a large channel with sufficient cross sectional area to function as an energy dissipator.

The levees, constructed of soil cement, would be approximately 12 feet high with a minimum 8 foot toe down. The levee on the east side would protect the houses, and bank stabilization would be needed on the west side to protect the cut and fill slopes of I-17. The levee would be approximately 7,000 feet long.

Unfortunately, this solution also has negative environmental impacts. The levees themselves will be large, approximately 12 feet tall and 86 feet thick at the base. Sight lines of the residences would be compromised by the very levees designed to protect them. The levees would be constructed of soil cement for structural and maintenance reasons, and the channel would be cleared of vegetation to allow for hydraulic efficiency which would eliminate wildlife habitat.

This project would require an individual 404 permit from the U.S. Army Corps of Engineers taking approximately one to two years to obtain. On-site vegetative mitigation would be impossible due to the high velocities anticipated; off-site mitigation may be contested by the natural resource agencies. The project itself, regardless of the mitigation plan, would raise strong objections from the environmental community because of the highly desirable riverine habitat that would be destroyed by the project. Approximately 122 acres would be negatively impacted by the project. The estimated mitigation cost is \$8200 per acre for a total mitigation cost of just over one million dollars.

The estimated cost for this alternative is \$17.9 million. See the chart titled "New River Alternatives" on the page following the text for a cost comparison with the other alternatives.

A lower levee could be constructed to protect the homes from lower events, but would not be recommend because the levees would provide a sense of false security while the potential for loss of life and property damage would be increased. The 100-year floodplain would not be reduced by any levee that could not contain the 100-year event. A lower levee would still have a

negative environmental impact - it may require an extended length of time to secure a Section 404 permit from the U.S. Army Corps of Engineers.

**Alternative #3: Construct a dam.**

A dam upstream of the study reach would retard flood flows and meter them out at a very reduced flow rate. The water flow out of the dam could be reduced to the point where there would be essentially no flooding problem for the houses along the upper New River channel. The closest site, with available reservoir capacity, would be across the New River canyon just upstream of the Table Mesa Road exit off of I-17 (see attached maps). The dam would be an earth fill structure approximately 100 feet tall and 3,000 feet long with a concrete emergency spillway over the dam. The reservoir area would cover approximately 500 acres and flood several ranches. The District's 1963 Comprehensive Plan proposed a dam on New River at this location, along with a diversion channel to carry the water west to the Agua Fria River.

Constructing the dam further downstream would jeopardize I-17. The geology at this site has not been considered for this analysis. Geologic investigation may render the potential dam sites unsafe. A dam at any of the locations would have negative environmental impacts. It would upset the natural flow of the river and alter the ground water flow paths. This in turn will negatively impact the riverine vegetation and the wildlife which lives there.

This project would also require an individual 404 permit from the U.S. Army Corps of Engineers which could take 1 to 2 years to obtain. Many of the same objections of the levees would apply, but at a larger scale because the dam would affect approximately 700 acres compared with the 122 acres of the levees. Vegetation in the reservoir area behind the dam would be drowned by the water. The ground water table downstream from the dam would be restricted (lowered) by the foundation and grout curtain of the dam. Lowering of the ground water table would negatively impact the vegetation. [The estimated mitigation cost for 700 acres is approximately \$5.7 million.]

Dam  
mitig  
\$ 5.7 mil

Additionally, there are several ranches and homes in the reservoir area which will have to be re/located.

The cost of the dam has been estimated to be approximately \$30 million. Additional items to be investigated that may escalate the costs would be the subsurface geology - fractured rock at the dam site could increase the cost of the structure by 50% or more.

+ 30 mil

A smaller dam could be constructed to protect the homes from lower events, but would not be recommended because the dam would decrease the 100-year floodplain along New River, thereby allowing for more development to occur along the river banks.

**Alternative #4: Buy-out.**

This solution addresses the houses rather than the river. There are 25 houses in the floodway. The estimated cost to buy the houses, vacant properties, and all of the associated relocation costs (using Federal guidelines) is \$2,200,000.

The District has not formulated guidelines for this type of relocation project, i.e., a relocation would have to include all of the homes in the flood hazard area, not just some of them; the District would relocate the residents, not pay them the cash value of the houses, etc....The details of a policy would need to be worked out if it is decided to implement this alternative.

With this alternative, there is the associated issue of Federal assistance to re-build houses that have been damaged by flooding; the houses in this area suffering up to 49% of the value of the house in flood damages, would qualify for Federal assistance to rebuild. A condition of the Federal assistance would be that the homeowner MUST purchase flood insurance. If the flood damage is 50% of the value of the house, or greater, the Federal government will not assist in rebuilding the house.

This buy-out alternative is much less expensive than the previous solutions. However, the residents may object to being moved out of the floodplain for safety reasons because it is the aesthetic qualities of the floodplain (vegetation, shade, wildlife, cool temperatures) which attracted the people to settle there in the first place.

PRIORITIZATION

As part of the evaluation, all alternatives were scored according to the DISTRICT's new prioritization procedure, except for the no-action alternative. The prioritization procedure scores projects in ten categories, with a total of 100 points possible per project (see Prioritization Criteria following the "Project Priority Worksheets"). The scoring for each alternative is shown on the following pages. The scoring results are listed below.

ALTERNATIVE 1 - no action, not scored  
ALTERNATIVE 2 - construct a levee, 33  
ALTERNATIVE 3 - construct a dam, 33  
ALTERNATIVE 4 - "buy-out", 43

The significance of the scoring, in absolute terms, is that all of the alternatives score low on the 0-100 scale. In relative terms, the buy-out alternative (43) scores higher than the two structural alternatives.

RECOMMENDATION:

FIRST CHOICE:

Alternative #1, no action.

SECOND CHOICE:

Alternative #4, buy-out.

The District would develop a policy for the Board of Directors' approval which would establish criteria and guidelines to address the purchase of homes that are in the existing floodway and the relocation of the residents.

Note: Alternatives #2 and #3 are not considered feasible. The construction cost is 8-18 times the value of the homes, and the environmental damage is high. It is also possible that an environmental permit may not be issued for either of these alternatives.

# NEW RIVER ALTERNATIVES

## Alternative Cost Schedule

**1 Do Nothing** \$0

**2 Levee**

Length	Height	Cutoff	Top Width
7000	12	8	14

	Units	QTY	Unit Cost	Cost
Fill(soil cement)	CY	383704	\$30.00	\$11,511,111
Clr & Grb	Acres	33	\$1,500	\$49,174
Mobilization	LS	1	\$150,000	\$150,000
Stabilization	SY	9621	\$35	\$336,720
Contingency	%	25		\$3,011,751
Engineering	%	10		\$1,505,876
Land	Acres	33	\$12,000	\$393,388
Env. Mitigation	Acres	122	\$8,200	\$1,000,400
				<u>\$17,958,420</u>

**3 Dam**

Length	Height	Cutoff	Top Width
3000	100	12	14

	Units	QTY	Unit Cost	Cost
Fill	CY	4,355,556	\$5	\$21,777,778
Clr & Grb	Acres	47	\$1,500	\$70,868
Outlet Works	LS	1	\$200,000	\$200,000
Mobilization	LS	1	\$50,000	\$50,000
Contingency	%	15		\$3,314,797
Engineering	%	10		\$2,541,344
Land	Acres	500	\$12,000	\$6,000,000
Env. Mitigation	Acres	700	\$8,200	\$5,740,000
				<u>\$39,694,787</u>

**4 Buy Out**

	Units	QTY	Unit Cost	Cost
Relocations	Ea	25	\$24,000	\$600,000
Properties	Ea	32	\$50,000	\$1,600,000
				<u>\$2,200,000</u>

## Project Priority Worksheet

**Project Name:** New River Alternate 2 - Levee

Factor	Range			Points
	Low	Medium	High	
Developed Area Protected	0-7	8-14	15-20	5
Hydrological/Hydraulic Signif	0-3	4-7	8-10	8
Total Area Protected	0-2	3-5	6-8	2
Master Plan Element	0-2	3-4	5-6	0
Level of Protection	<u>2-10 yr</u>	<u>11-50 yr</u>	<u>above 50 yr</u>	10
	0-5	6-8	9-10	
Environ/Areawide Benefits	<u>Low</u>	<u>Medium</u>	<u>High</u>	
Water Quality	0-2	3-4	5-6	0
Wildlife Habitat	0-2	3-4	5-6	2
Groundwater	0-1	2-3	4	0
Recreation	0-1	2-3	4	0
Total Project Cost	<u>under \$5M</u>	<u>\$5-15M</u>	<u>above \$15M</u>	1
	6	4-5	0-3	
O & M Costs	<u>Low</u>	<u>Medium</u>	<u>High</u>	5
	5	3-4	0-2	
Local Priority	0-1	2-4	5	0
Local Participation	<u>0-30%</u>	<u>31-60%</u>	<u>above 60%</u>	0
	0-4	5-9	10	
<b>TOTAL</b>				<b>33</b>

Project Description: This alternate consists of constructing a soil cement levee along the east side of the bank to protect the residents from the flows. The height of the levees would be approximately 12 feet in height with 3 to 1 slopes and a 14 feet wide top width. The levee would also be approximately 7,000 feet in length. The west bank of New River for this reach is also the fill slopes of the I-17 northbound lanes. Because of this, this alternative includes bank protection along the west banks opposite of the levee construction. Some of the residents that are to be protected will have to be relocated to construct the levee.

## Project Priority Worksheet

**Project Name:** New River Alternate 3 - Dam

Factor	Range			Points
	<u>Low</u>	<u>Medium</u>	<u>High</u>	
Developed Area Protected	0-7	8-14	15-20	7
Hydrological/Hydraulic Signif	0-3	4-7	8-10	8
Total Area Protected	0-2	3-5	6-8	4
Master Plan Element	0-2	3-4	5-6	0
Level of Protection	<u>2-10 yr</u>	<u>11-50 yr</u>	<u>above 50 yr</u>	10
	0-5	6-8	9-10	
Environ/Areawide Benefits	<u>Low</u>	<u>Medium</u>	<u>High</u>	
Water Quality	0-2	3-4	5-6	0
Wildlife Habitat	0-2	3-4	5-6	0
Groundwater	0-1	2-3	4	1
Recreation	0-1	2-3	4	0
Total Project Cost	<u>under \$5M</u>	<u>\$5-15M</u>	<u>above \$15M</u>	0
	6	4-5	0-3	
O & M Costs	<u>Low</u>	<u>Medium</u>	<u>High</u>	3
	5	3-4	0-2	
Local Priority	0-1	2-4	5	0
Local Participation	<u>0-30%</u>	<u>31-60%</u>	<u>above 60%</u>	0
	0-4	5-9	10	
<b>TOTAL</b>				<b>33</b>

Project Description: This alternate consists of constructing an earthen dam upstream of the residents along New River. The dam would be approximately 100 feet in height with 3 to 1 slopes and a 14 feet wide top width. The crest of the dam would be approximately 3,000 feet in length. The area that would be inundated from the one-hundred year event is approximately 500 acres. Three ranches are located in this area.

## Project Priority Worksheet

**Project Name:** New River Alternate 4 - Buy-out

Factor	Range			Points
	<u>Low</u>	<u>Medium</u>	<u>High</u>	
Developed Area Protected	0-7	8-14	15-20	7
Hydrological/Hydraulic Signif	0-3	4-7	8-10	8
Total Area Protected	0-2	3-5	6-8	0
Master Plan Element	0-2	3-4	5-6	0
Level of Protection	<u>2-10 yr</u>	<u>11-50 yr</u>	<u>above 50 yr</u>	10
	0-5	6-8	9-10	
Environ/Areawide Benefits	<u>Low</u>	<u>Medium</u>	<u>High</u>	
Water Quality	0-2	3-4	5-6	1
Wildlife Habitat	0-2	3-4	5-6	4
Groundwater	0-1	2-3	4	2
Recreation	0-1	2-3	4	0
Total Project Cost	<u>under \$5M</u>	<u>\$5-15M</u>	<u>above \$15M</u>	6
	6	4-5	0-3	
O & M Costs	<u>Low</u>	<u>Medium</u>	<u>High</u>	5
	5	3-4	0-2	
Local Priority	0-1	2-4	5	0
Local Participation	<u>0-30%</u>	<u>31-60%</u>	<u>above 60%</u>	0
	0-4	5-9	10	
<b>TOTAL</b>				<b>43</b>

Project Description: This alternate consists of purchasing all of the residences that are currently in the floodway of New River upstream of the elementary school. This land could be set aside as prime area for future mitigation sites.

## PRIORITIZATION CRITERIA:

In order for staff to consider District-generated or agency-requested 5-Year CIP projects, the agencies having jurisdiction over stormwater drainage in the project area must be able to demonstrate that its regulations conform with or exceed the provisions of the Uniform Drainage Policies and Standards (UDPS) for Maricopa County. To satisfy this requirement, copies of pertinent ordinances should be referenced and/or attached to the project request. In the event that concerns arise, a joint determination of conformance will be made by the requesting agency and the District.

Each request which meets this minimum standard will be evaluated by District staff and scored on the Project Priority Worksheet (copy attached). Through the ten weighted criteria listed below, a maximum total of 100 points is possible per project. If insufficient data is provided for a particular criterion, the minimum number points will be awarded in that category. Projects will be ranked by staff according to total points received.

### 1. Developed Area Protected (20 points)

The request should provide a quantitative and qualitative summary of the benefits to be provided by the project. The types of information to be considered include the following:

- a. Number of residential, commercial and industrial buildings protected;
- b. Number of public buildings (schools, libraries, churches, etc.) protected;
- c. Amount of infrastructure (roads, drainage/flood control facilities, etc.) protected and/or enhanced (e.g., storm drain capacity increases from 2-year to 10-year);
- d. Amount of developed or cultivated acreage protected; and,
- e. Other.

### 2. Hydrologic/Hydraulic Significance (10 points)

The project request should describe existing watershed conditions. Where applicable, the description should assess both upstream and downstream of the project site. The types of information to be considered include the following:

- a. Peak discharge/frequency;

- b. Vegetation and wildlife habitat (6 points);
- c. Groundwater enhancement (4 points); and
- d. Recreational uses (4 points).

These benefits and/or impacts must be weighed against the flood control requirements of the project.

7. Total Project Cost (6 Points)

An estimate of the total design, land acquisition and construction costs, preferably by fiscal year, should be provided. At a minimum, qualitative information on environmental permitting/ mitigation and aesthetic/public acceptance costs should also be included.

8. Operation & Maintenance Costs (5 Points)

At a minimum, the request should qualitatively address expected costs in the area of operation & maintenance. The discussion should include whether the District, the requesting agency, or others will be expected to assume responsibility for operations, maintenance and replacement.

9. Agency Priority (5 Points)

Multiple project proposals from a single entity should be prioritized numerically prior to submittal. Separate projects must not be grouped into generalized categories such as high, medium, or low. However, a number of integrated projects required to improve a particular watershed may be classified as a single, phased project. As appropriate, the District will request an annual update of the agency's priority list.

10. Level of Local Participation (10 Points)

The requesting agency should submit information on the availability of matching funds. Among the factors to be considered are:

- a. Direct agency matching dollars available;
- b. An agency's financial capabilities and ad valorem contributions to the District;
- c. The availability of non-cash contributions (R/W donations or future O&M, for example);
- d. Previous agency flood control expenditures in the project area; and,
- e. The availability of funds from other sources, such as Federal matching funds or private contributions.

- b. Depth, velocity and duration of flow;
- c. Contributing watershed characteristics (size, slope, land use, etc.);
- d. Conveyance capacity of receiving waters; and,
- e. Other.

3. Total Area Protected (8 points)

An estimate of the total acreage, both developed and undeveloped, to receive protection from the project should be provided. The types of information to be considered include the following:

- a. Area removed from 100-year floodplain;
- b. Percentage of agency's jurisdictional area protected;
- c. Area of undeveloped, platted land protected;
- d. Environmentally sensitive areas protected;
- e. Area of vacant land protected; and,
- f. Other.

4. Master Plan Element (6 points)

Information on the relationship of the project to existing or ongoing, agency-sponsored flood control/stormwater management master plans should be provided. For projects that are components of an agency-sponsored master plan, points will be awarded on the basis of the request's relative significance to the overall plan.

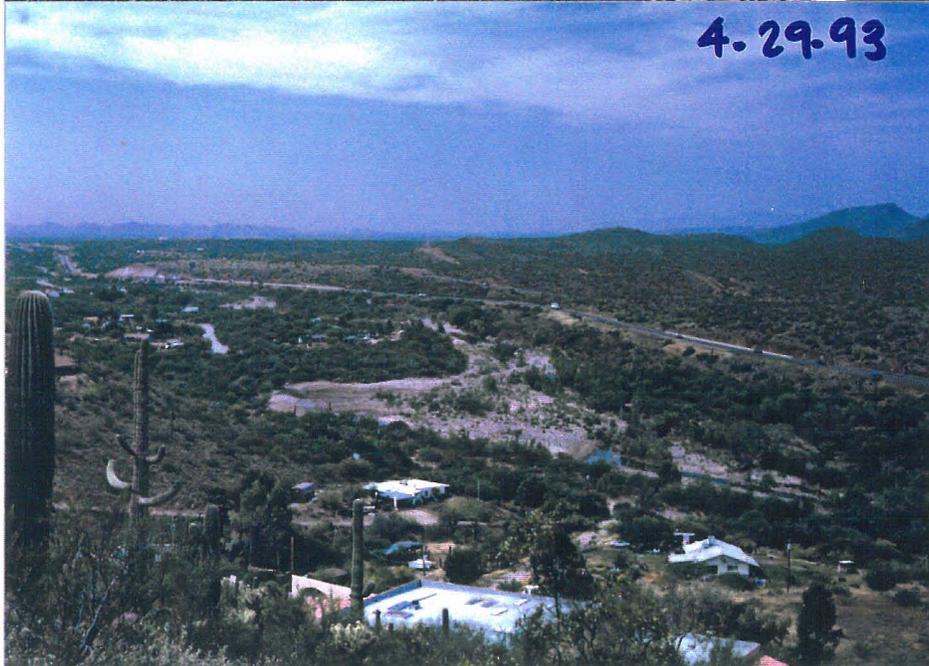
5. Level of Protection (10 Points)

All project requests should identify the level of protection to be provided. Protection level estimates can include incidental protection, such as that provided by storm drains with curb and gutter roadways. The award of points in this category will also take into account the amount of protection afforded to existing development.

6. Environmental Quality/Areawide Benefits (20 Points)

The request should provide sufficient detail to allow an evaluation of project benefits and/or impacts in the areas of:

- a. Water quality (6 points);



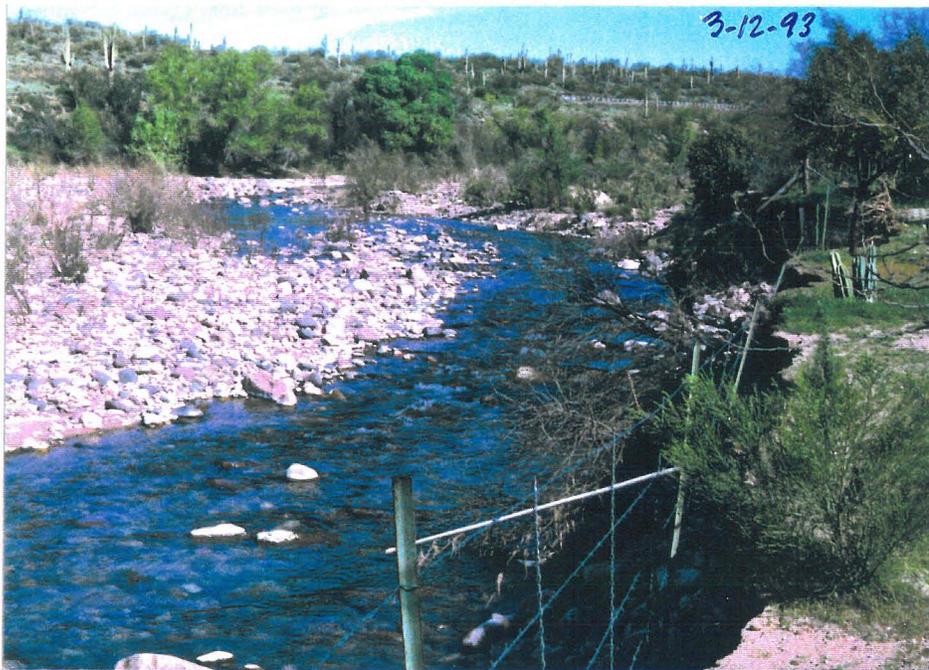
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SCS EMERGENCY WORK  
at NEW RIVER



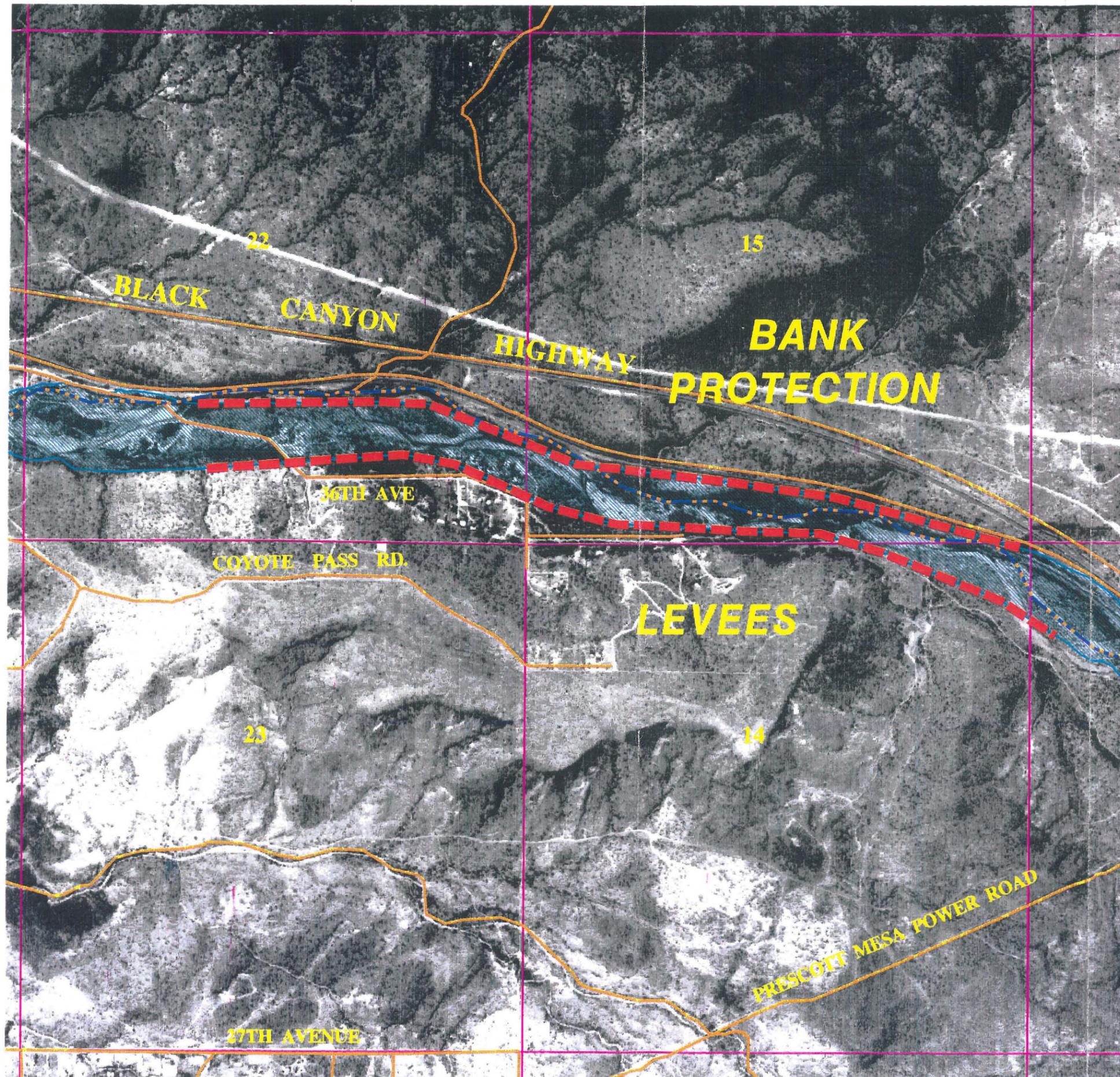
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SCS EMERGENCY WORK at NEW RIVER

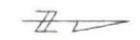


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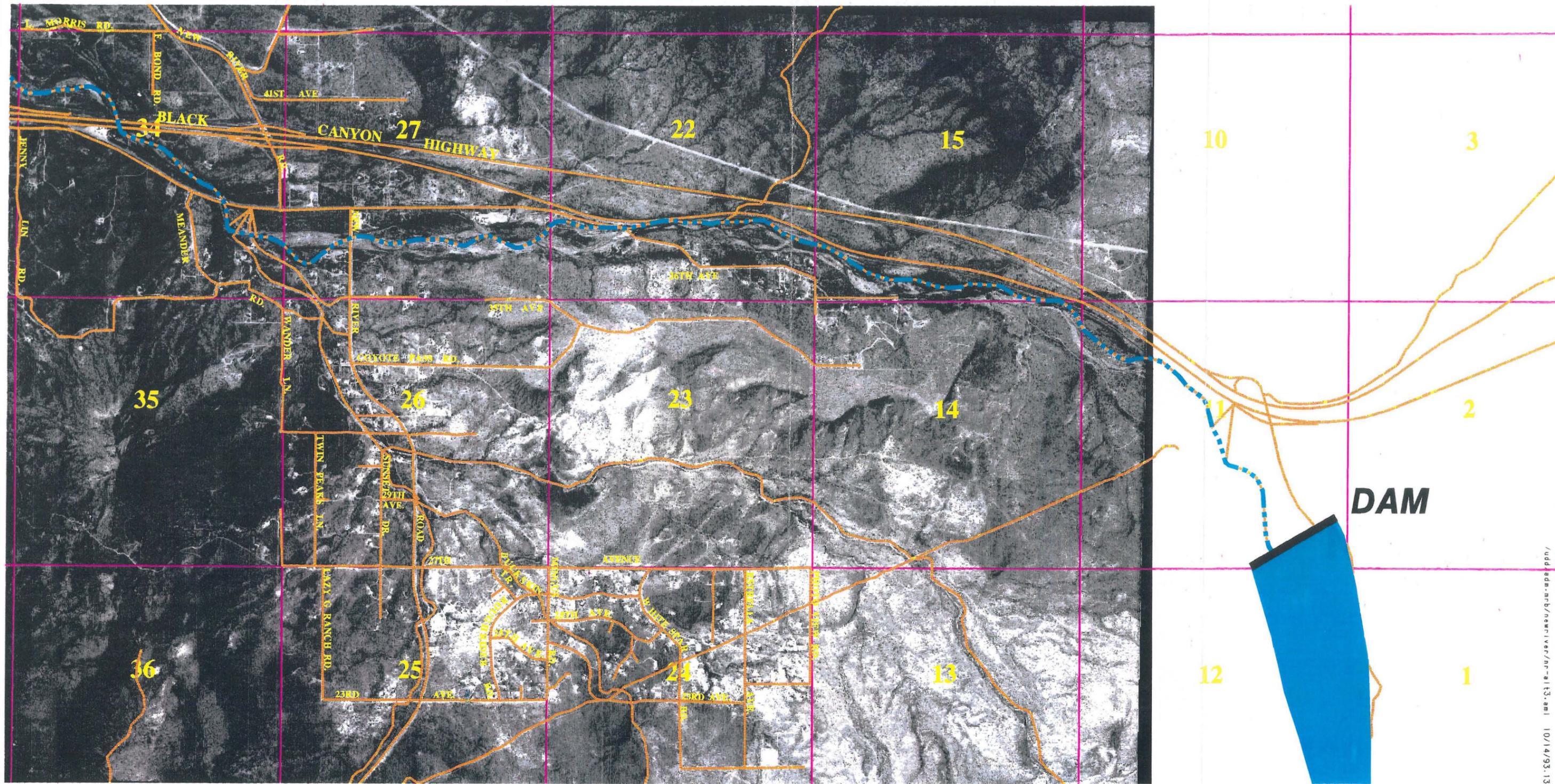
SCS EMERGENCY WORK  
at NEW RIVER



**NEW RIVER  
AREA  
ALTERNATE  
NO. 2**



NOT TO SCALE

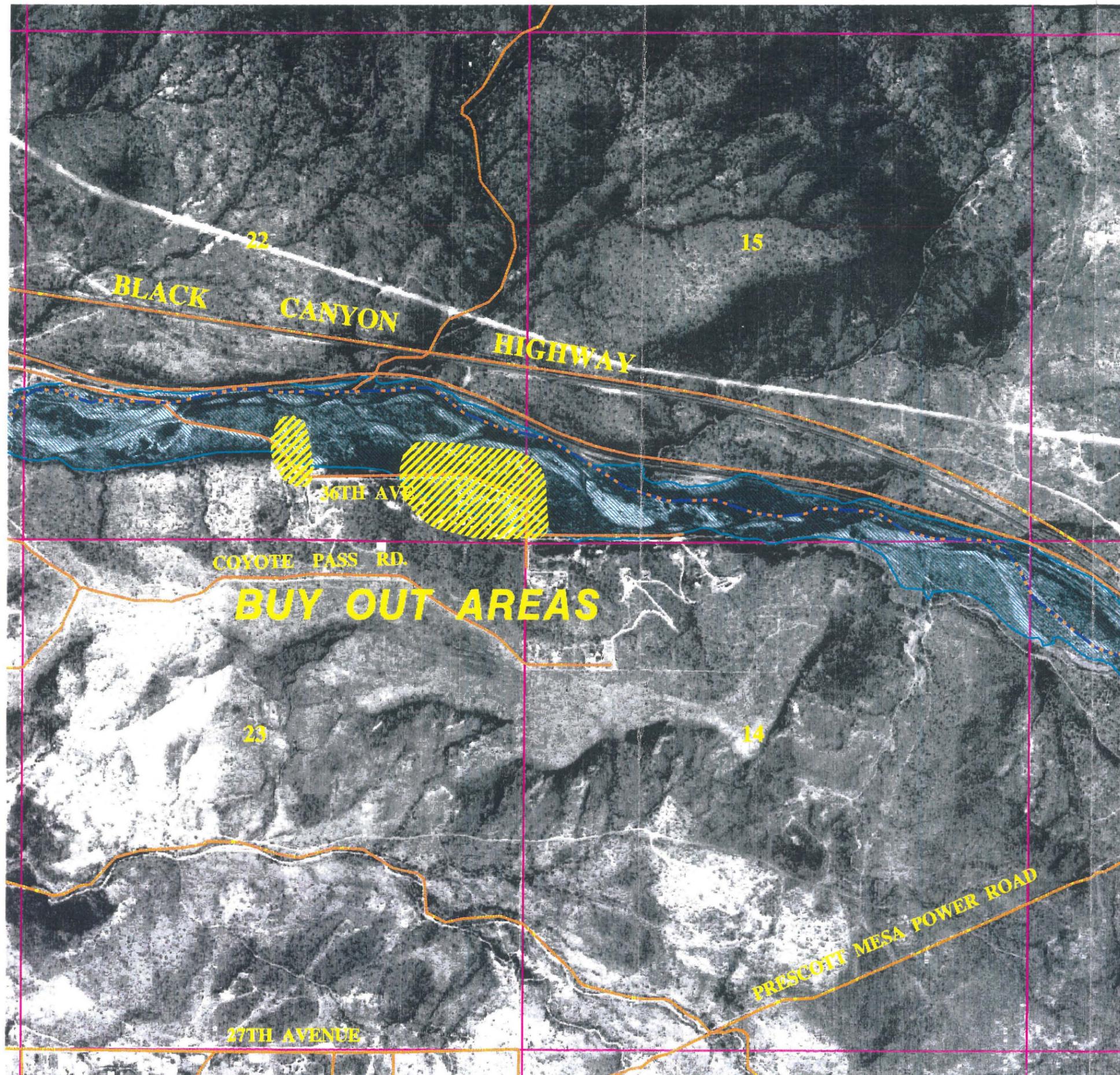


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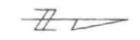
**DAM**

NOT TO SCALE

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**NEW RIVER  
AREA  
ALTERNATE  
NO. 4**



NOT TO SCALE