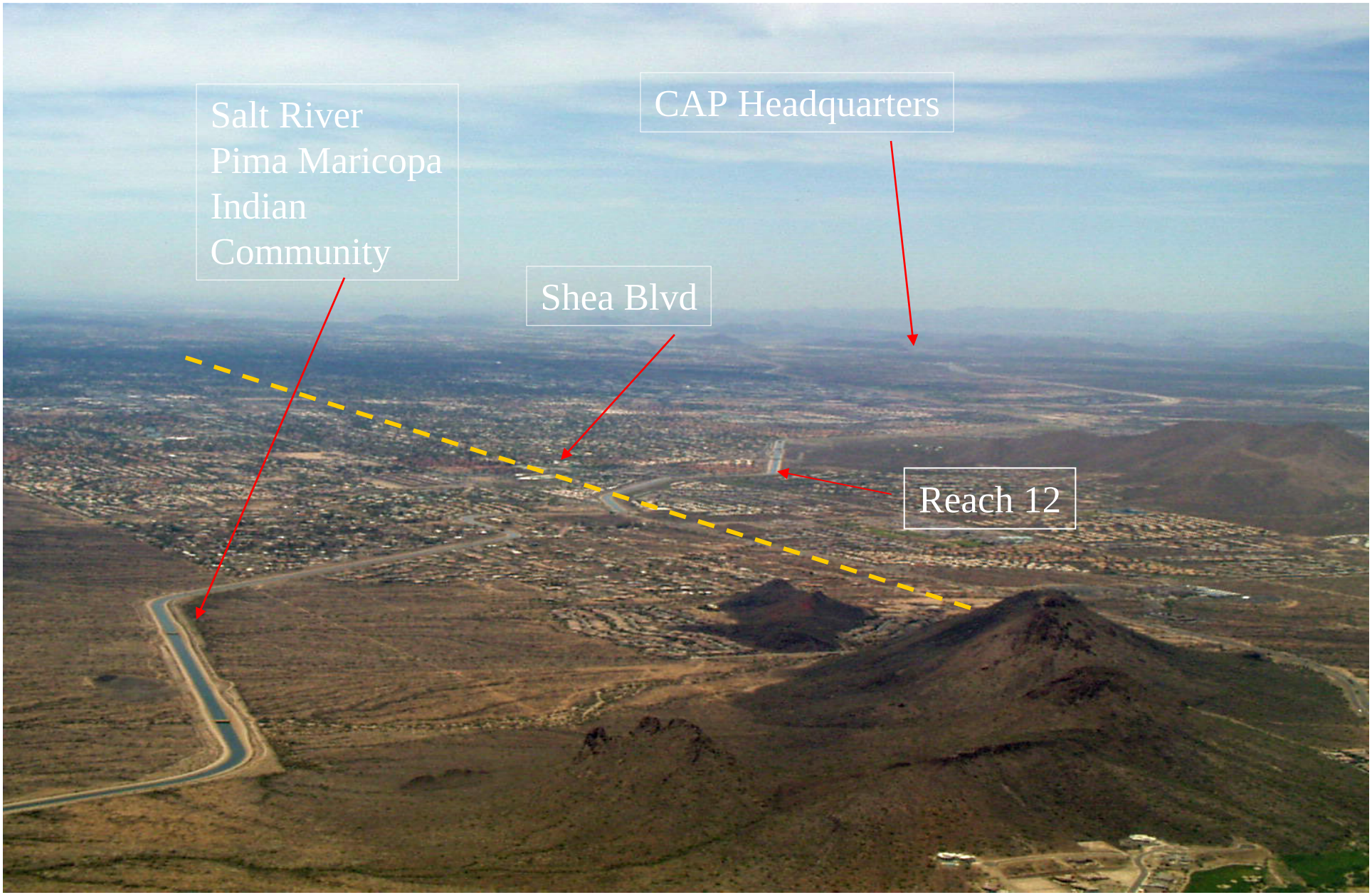
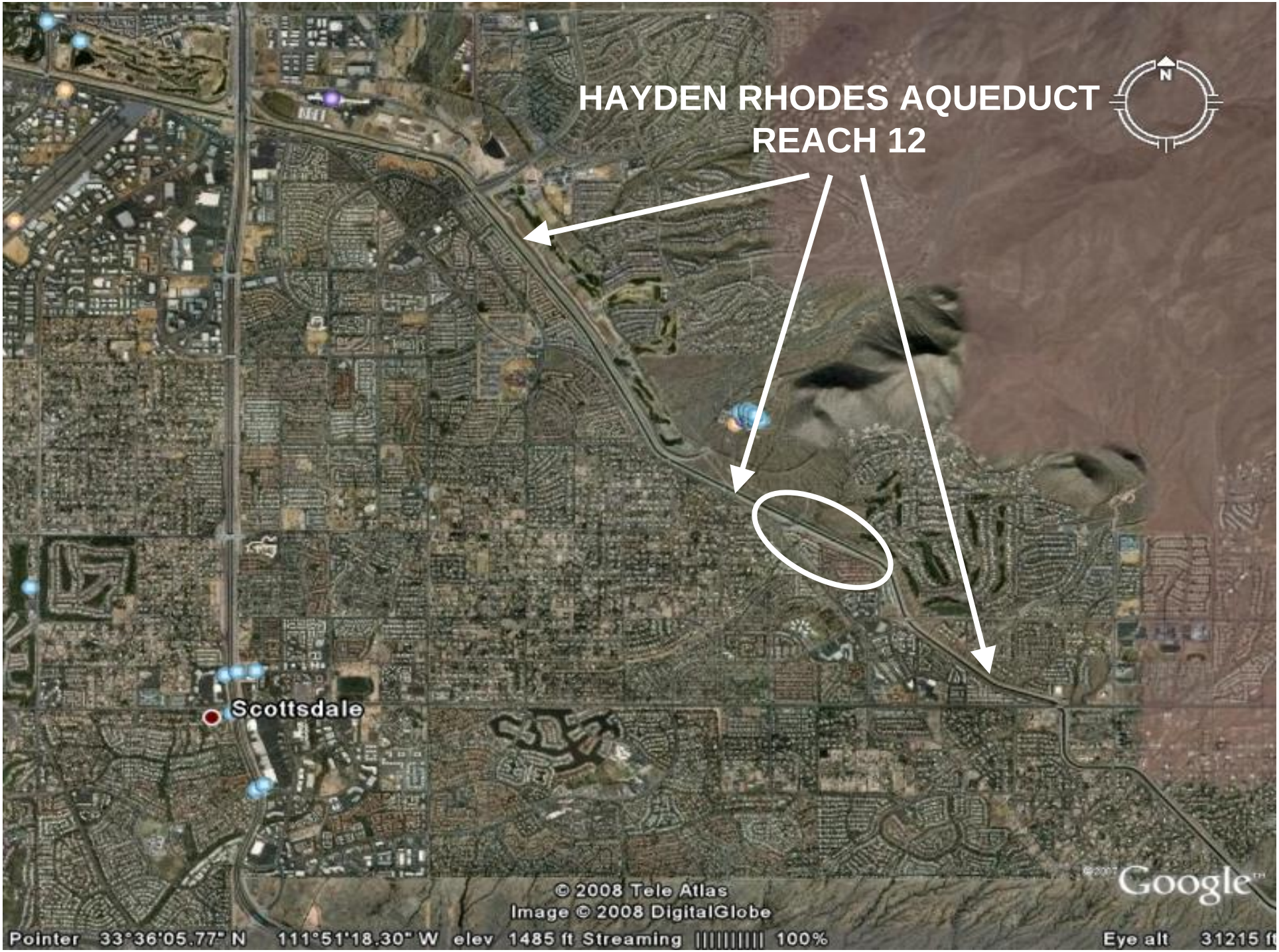
CAP

CENTRAL ARIZONA PROJECT

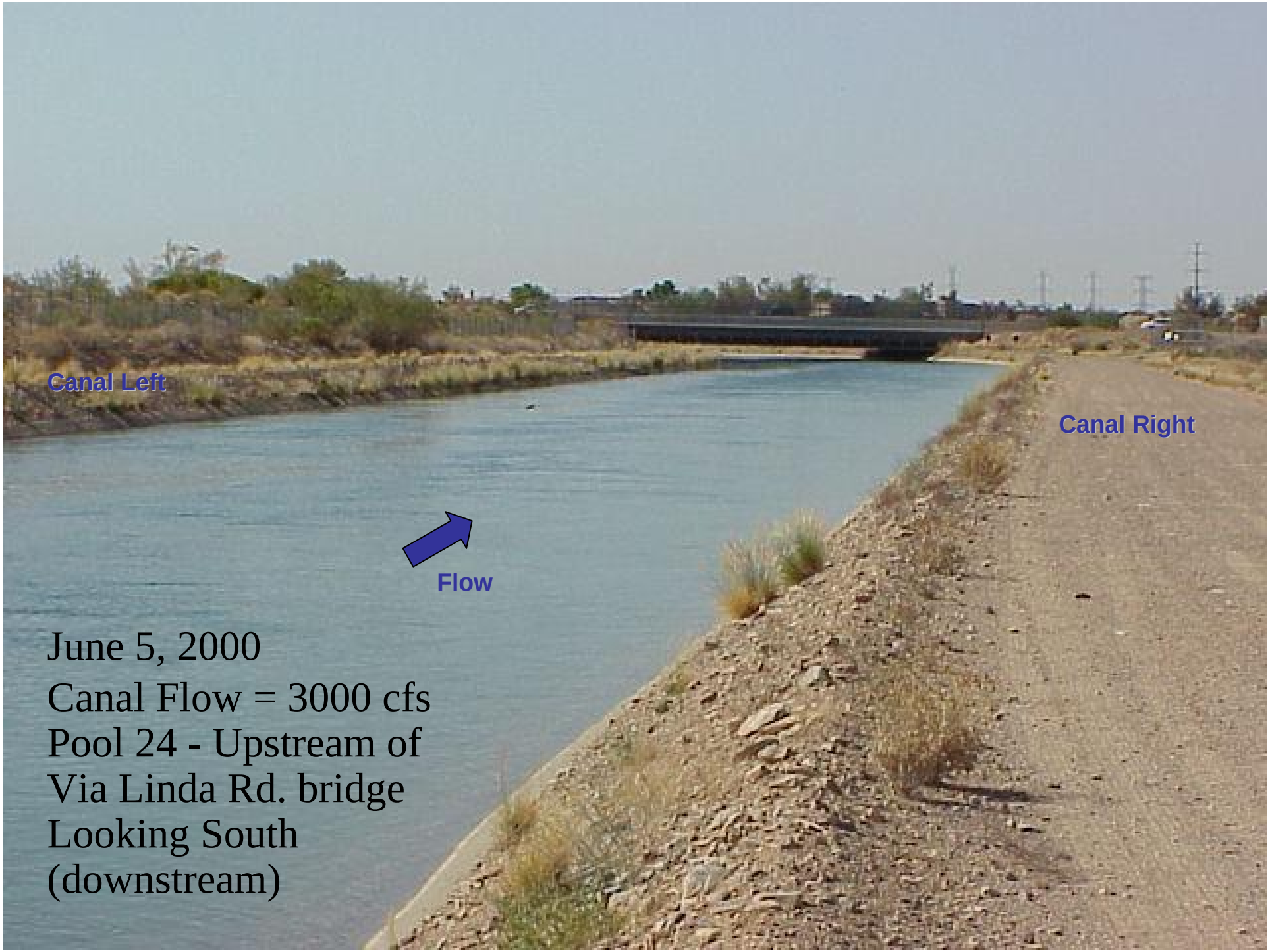
Hayden Rhodes Aqueduct
Reach 12

Reach 12 Subsidence Investigation




HAYDEN RHODES AQUEDUCT
REACH 12
N
Scottsdale
© 2008 Tele Atlas
Image © 2008 DigitalGlobe
Google
Pointer 33°36'05.77" N 111°51'18.30" W elev 1485 ft Streaming 100%
Eye alt 31215 ft

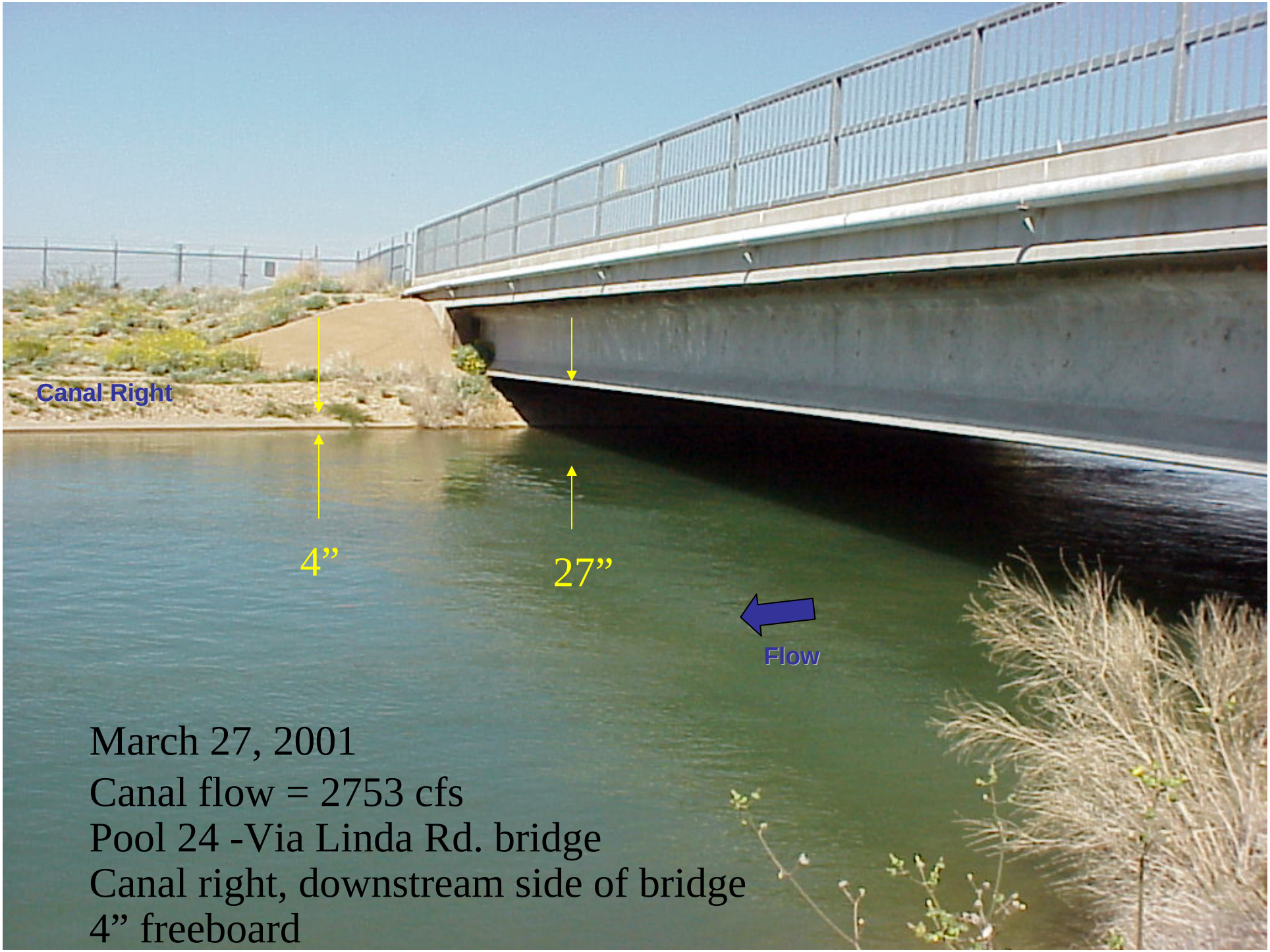
Garza Fissure
48 inch culvert
Flow
© 2008 Tele Atlas
Google
Pointer 33°35'42.92" N 111°50'14.54" W elev 1473 ft Streaming 100%
Eye alt 4278 ft


Canal Left
Canal Right
Flow
June 5, 2000
Canal Flow = 3000 cfs
Pool 24 - Upstream of
Via Linda Rd. bridge
Looking South
(downstream)

June 5, 2000
Canal flow = 3000 cfs
Pool 24 - Downstream of Via Linda Rd. bridge
Looking Southeast (downstream)

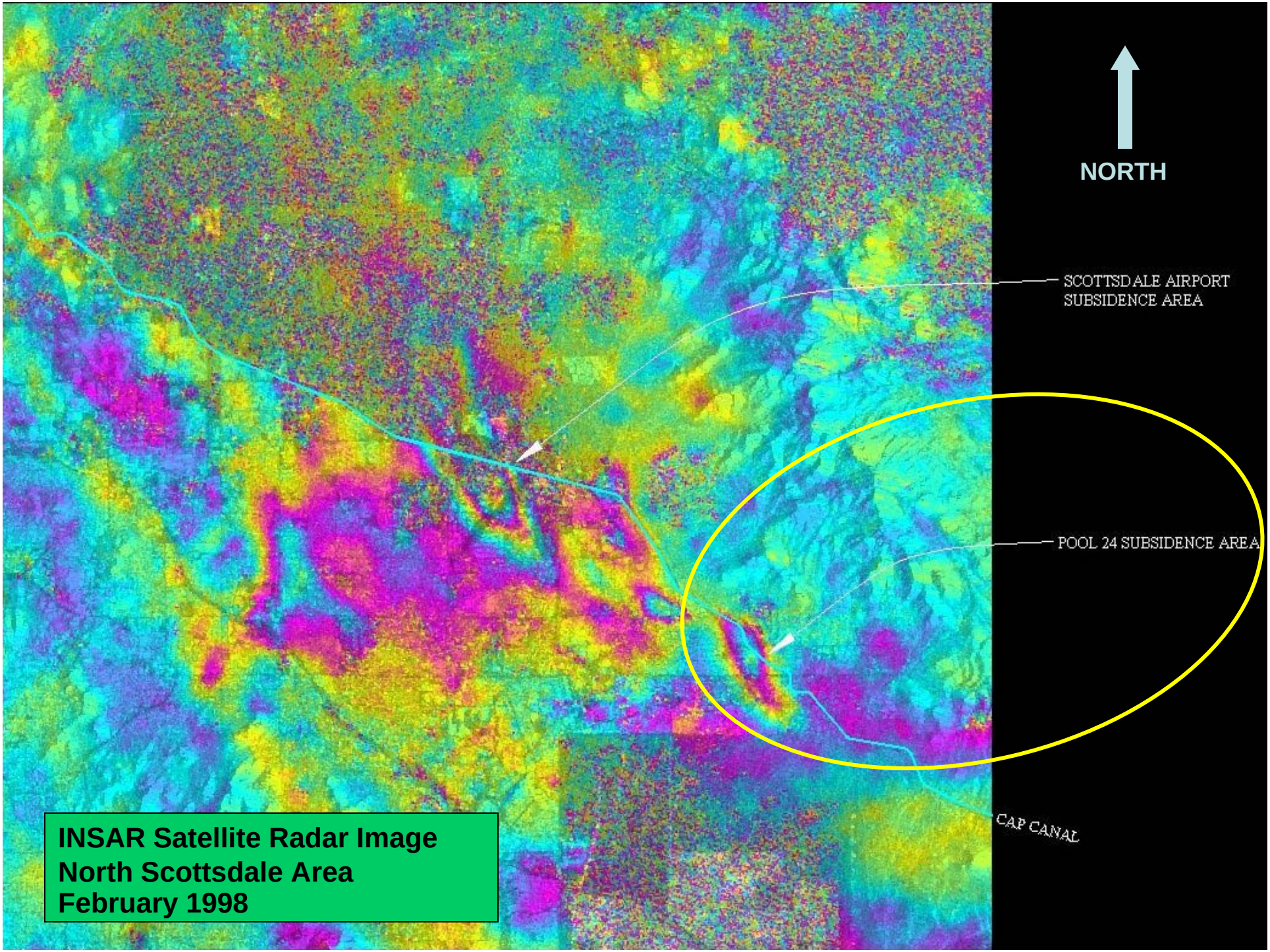
June 5, 2000
Canal flow = 3000 cfs
Pool 24 - Ancala Country Club pump station
Just upstream of Via Linda Rd. bridge
5” freeboard

March 27, 2001
Canal flow = 2753 cfs
Pool 24 - Upstream of Via Linda Rd. bridge
5” freeboard

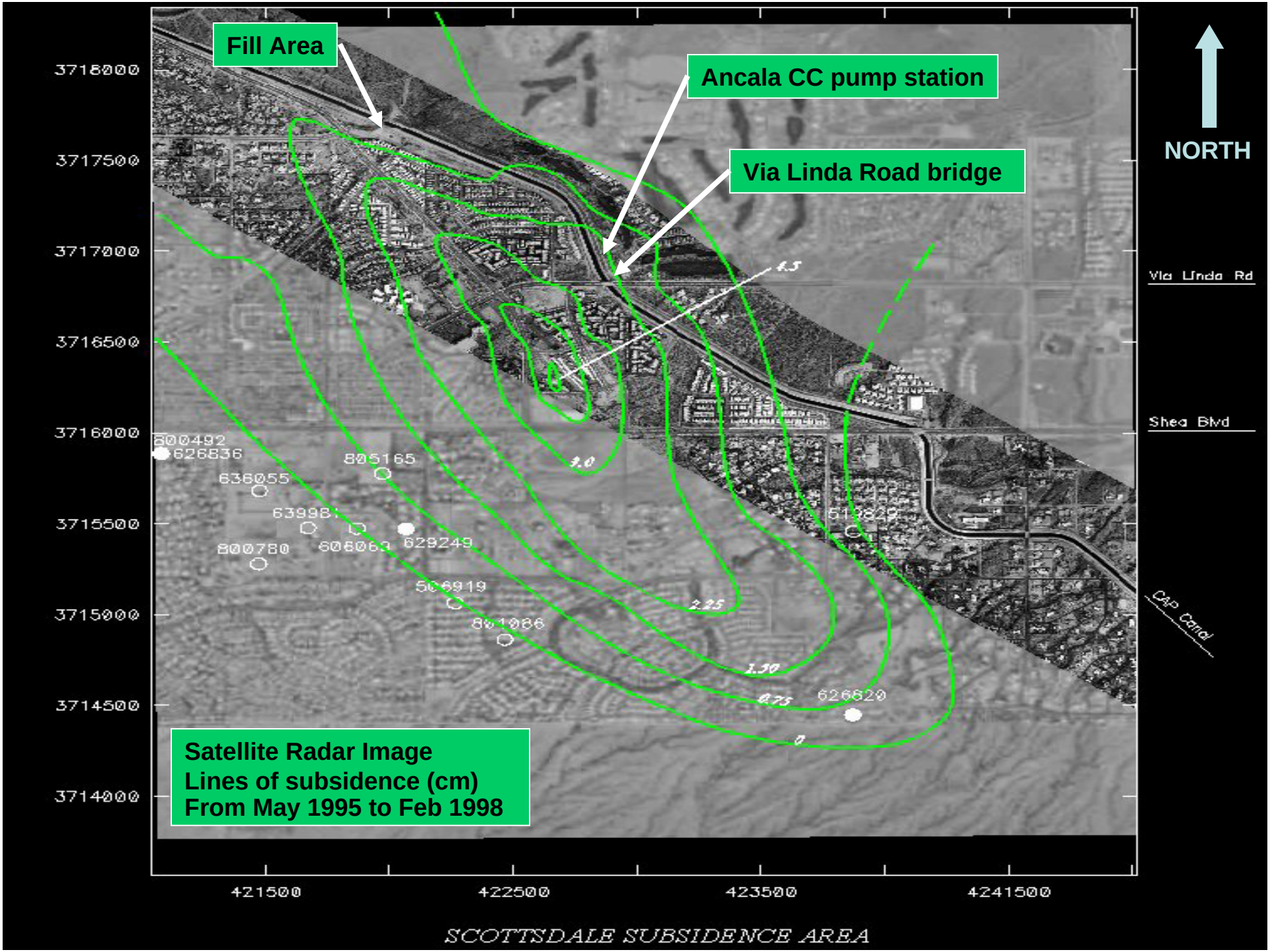


March 27, 2001
Canal flow = 2753 cfs
Pool 24 -Via Linda Rd. bridge
Canal right, downstream side of bridge
4” freeboard

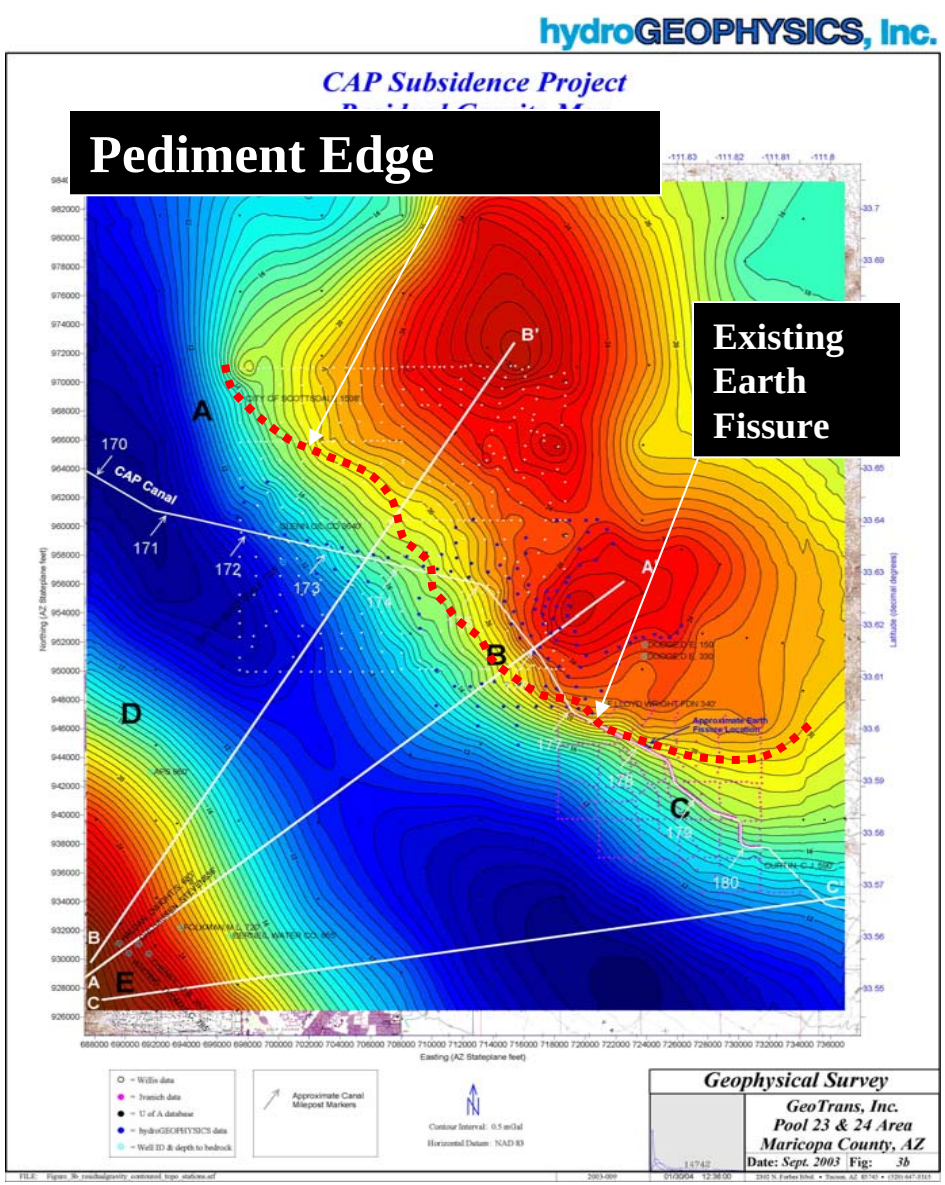
March 29, 2001
Canal flow = 2000 cfs
Pool 24 - Via Linda Rd. bridge
Canal right, upstream side of bridge
23” of lining freeboard
Lowest point of bridge to water surface = 46”
Canal Right
Flow
46”
23”



INSAR Satellite Radar Image
North Scottsdale Area
February 1998


Fill Area
Ancala CC pump station
Via Linda Road bridge
NORTH
Via Linda Rd
Shea Blvd
Cap Canal
Satellite Radar Image
Lines of subsidence (cm)
From May 1995 to Feb 1998
3718000
3717500
3717000
3716500
3716000
3715500
3715000
3714500
3714000
421500
422500
423500
4241500
1.5
1.0
2.25
1.50
0.75
0
800492
626836
636055
805165
800780
629249
626820
SCOTTSDALE SUBSIDENCE AREA

Gravity Survey to Predict Future Earth Fissures

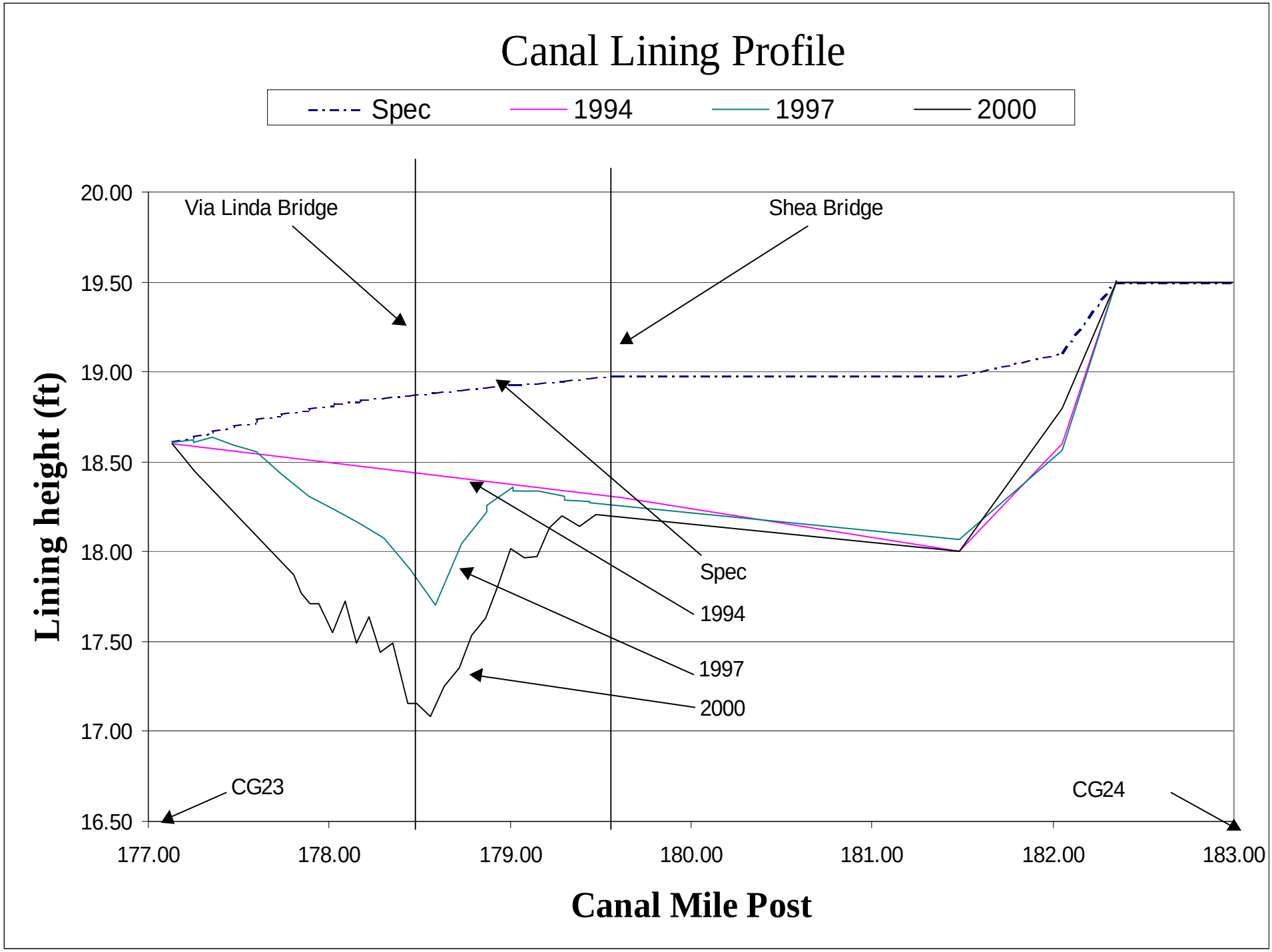


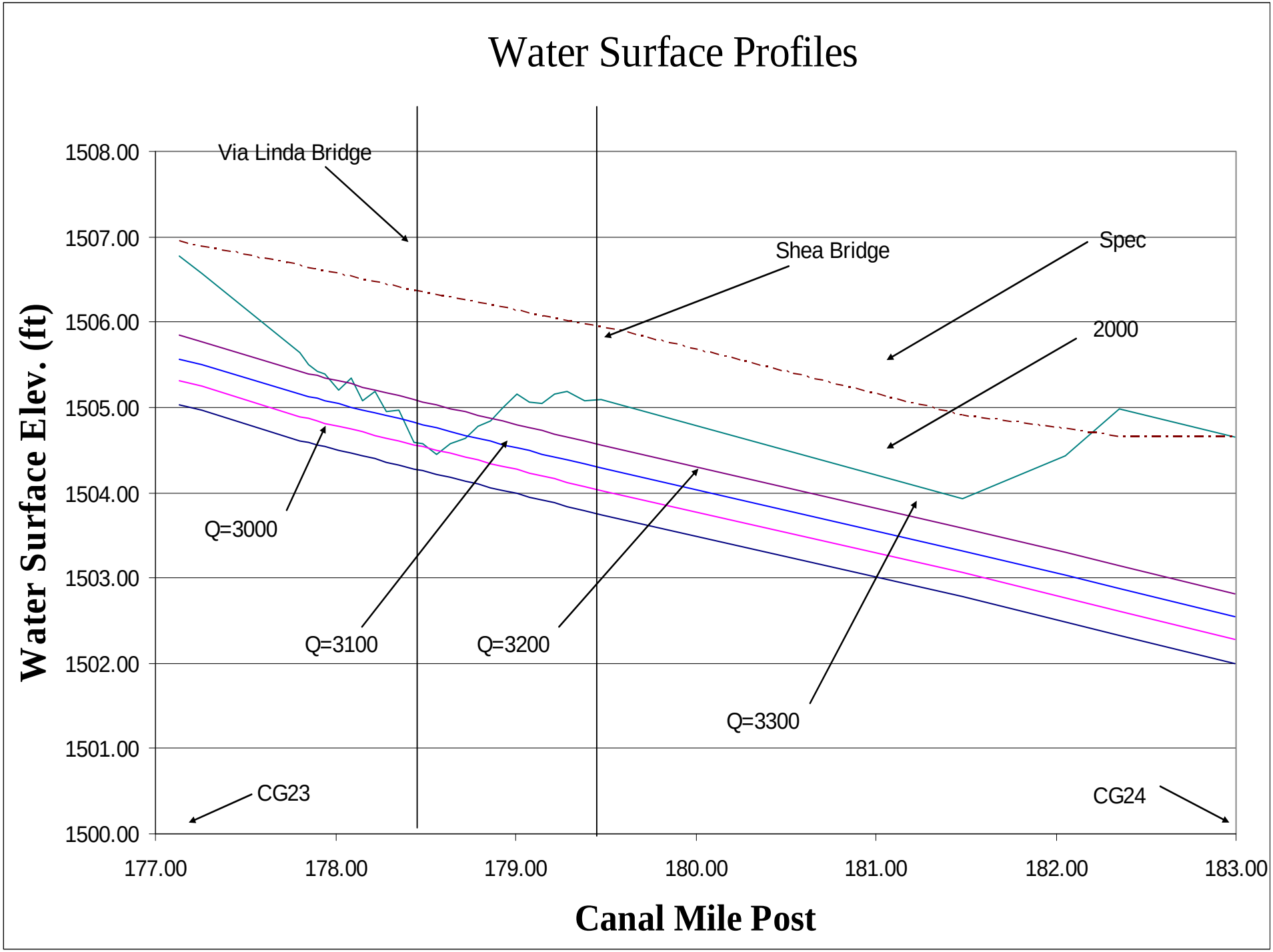
- **Objective**
  - Map shallow bedrock in proximity to deep basin sediments = high potential for earth fissures
- **Results**
  - Map shows areas where active subsidence and steep gravity gradients converge
  - <u>Thompson Peak Bridge</u> Mile Post 171 - 179

CAP Survey Data

Subsidence since original construction

Original construction - 1994	-0.4 feet
1994 - 1997	-0.7 feet more
1997 - 2000	-0.6 feet more
Total change	-1.7 feet


Canal Lining Profile
Spec
1994
1997
2000
Via Linda Bridge
Shea Bridge
Spec
1994
1997
2000
CG23
CG24
20.00
19.50
19.00
18.50
18.00
17.50
17.00
16.50
177.00
178.00
179.00
180.00
181.00
182.00
183.00
Lining height (ft)
Canal Mile Post

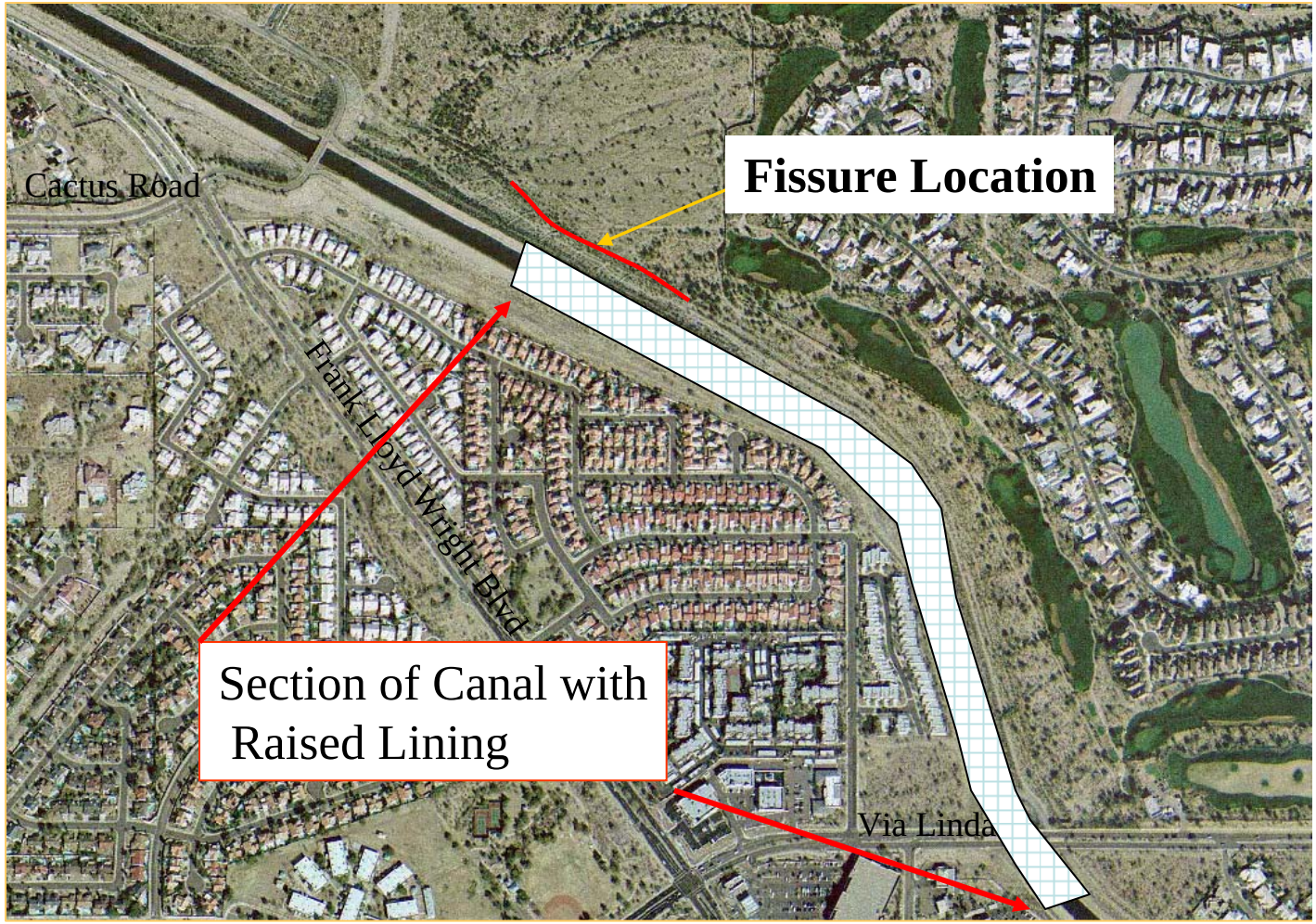

Water Surface Profiles
Via Linda Bridge
Shea Bridge
Spec
2000
Q=3000
Q=3100
Q=3200
Q=3300
CG23
CG24
1508.00
1507.00
1506.00
1505.00
1504.00
1503.00
1502.00
1501.00
1500.00
177.00
178.00
179.00
180.00
181.00
182.00
183.00
Water Surface Elev. (ft)
Canal Mile Post

2000 Strategy

- Short Term
  - April 2001: Thorough re-survey of problem area
  - Summer 2001: Operate carefully, patch as required
  - 2002: Install additional concrete lining
  - Cost: $200,000

- Longer Term
  - 2002-2005: 3-year comprehensive area study
  - Partner with Scottsdale, Phoenix, Maricopa County, USGS
  - Cost: $500,000

Earth Fissures



- Earth Fissure discovered January 2003 – 600 ft. long
- Located near 114th Street south of the Cactus Road Alignment
- Fissure is parallel to canal, relatively stable, not an immediate threat

Possible Long Term Strategy

- Hydrogeologic Analysis
  - Assess geologic conditions – thickness of compressible clays
  - Assess hydrologic conditions – groundwater use, water level declines
- Map Subsidence Areas, Timing & Magnitude
  - INSAR (satellite imaging)
  - Vertical and horizontal high precision GPS surveying
  - Map existing earth fissures
- Predict (model) Future Conditions
  - Conduct Gravity Survey to identify areas at risk for fissure development
  - Construct groundwater model to project impacts to aquifer from pumping
  - Drill boreholes in high subsidence risk areas for model inputs
  - Construct Aquifer Compaction model to project timing and magnitude of subsidence
- Recommend Mitigation / Corrective Actions

CAP

CENTRAL ARIZONA PROJECT

QUESTIONS?