

Arizona Water Jacks: Oak Creek Low Water Crossing

Devin Kelley

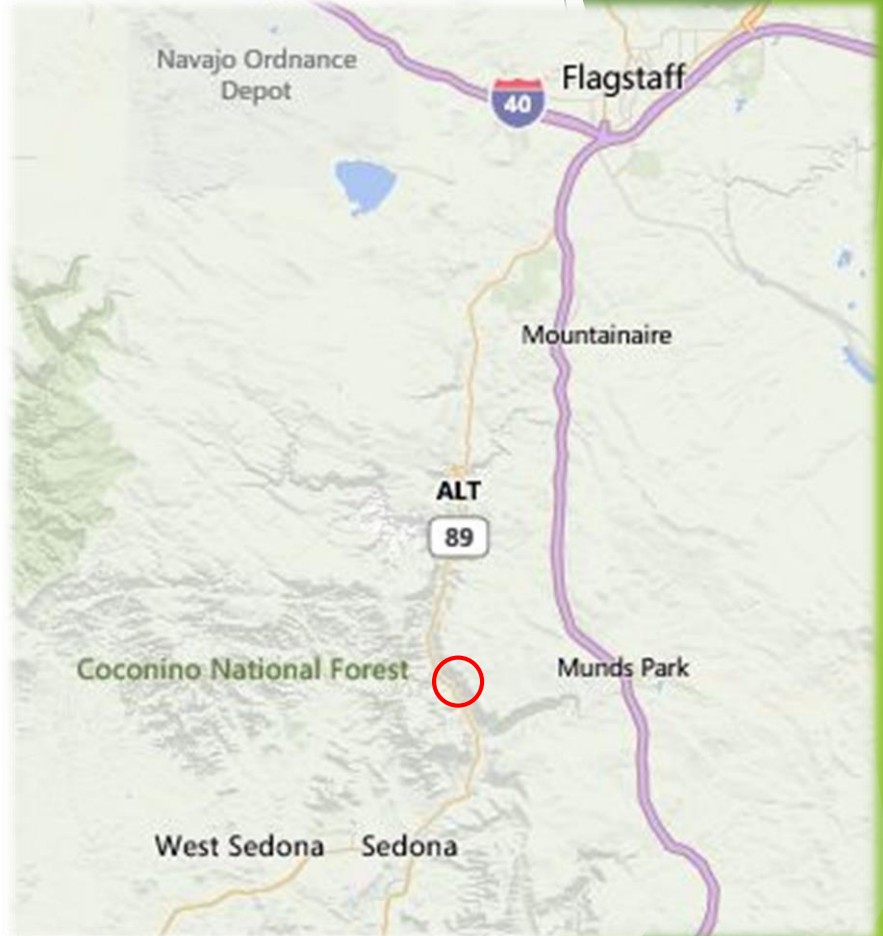
Hilary Sizemore

Fawaz Alotaibi

Bruce Connolly

About the Project

- ▶ Low water crossing through Oak Creek
- ▶ Service the Rancho Mission/Shangri-La Subdivision
- ▶ Floods are problematic in the area
 - ▶ Flood of 1993
- ▶ Only egress and ingress to subdivision



The project site (circled in red) showing its relation to Flagstaff and Sedona

Courtesy of Bing Maps

Client and Technical Advisor

- ▶ Client - Beth Ann Dzierson, Head of POA
- ▶ Technical Advisor - Mark Lamer, P.E., MEng., Instructor at NAU

Needs of the Client

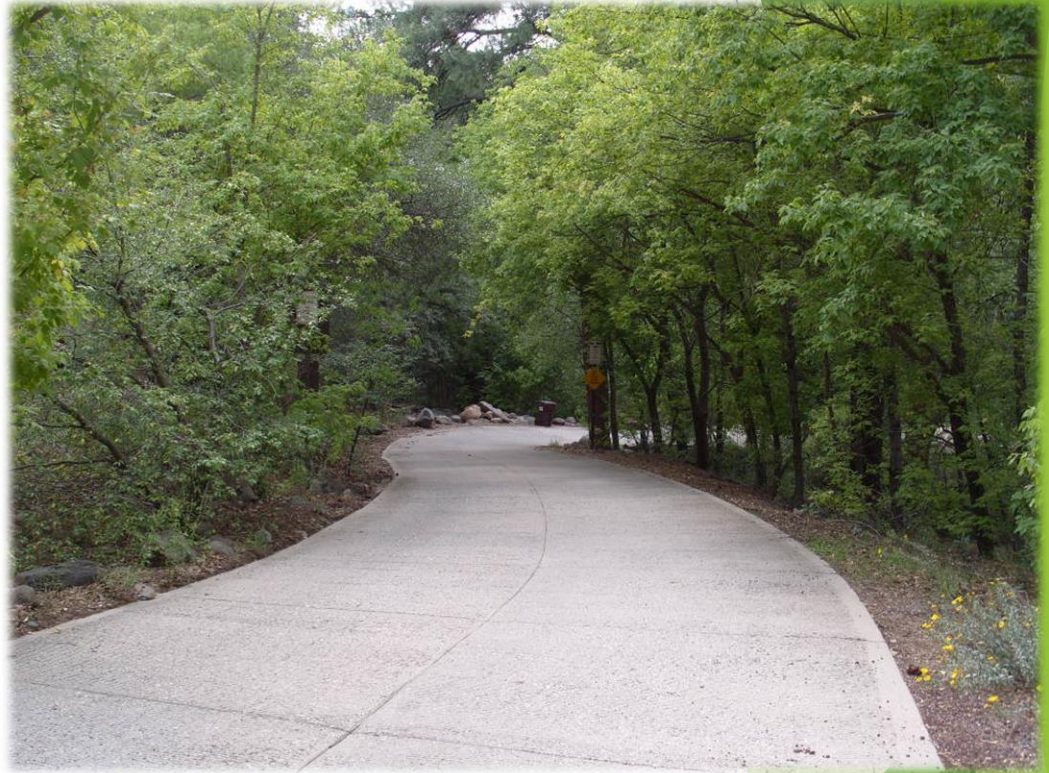
- ▶ Protect the current crossing
 - ▶ Scouring
 - ▶ Geomorphology
- ▶ Design a new crossing



The geomorphology of Oak Creek
(notice the natural beach on the left side)

Stakeholders

- ▶ Client - Beth Ann Dzierson (Head of POA)
- ▶ Shangri-La residents



The road heading down towards the water crossing

Existing Conditions

- ▶ 40 feet long and 14 ½ feet wide
- ▶ Four 48” concrete culverts
- ▶ Weight limit of 30 tons



The sign shown the weight limit of the current crossing

Existing Conditions



The view of the crossing looking towards 89-A



The crossing as seen from the natural beach

Scope (Research)

- ▶ Army Corps
- ▶ ADEQ
- ▶ ADOT



The flora in the crossing's surrounding area

Scope (Research)

- ▶ EPA
- ▶ Forest Service
- ▶ AZ Game and Fish



Scope (Modeling)

- ▶ Project Survey
- ▶ USGS
- ▶ HEC-HMS
- ▶ HEC-RAS



Surveying around Oak Creek at the project site

Scope (Impacts)

- ▶ Political
 - ▶ Sensitivity
- ▶ Social
 - ▶ Economy



Oak Creek is vital to many aspects of the local community, such as Slide Rock State Park which attracts tourists

http://northernword.com/2009/01/more_from_sedona/

Scope (Analysis and Design)

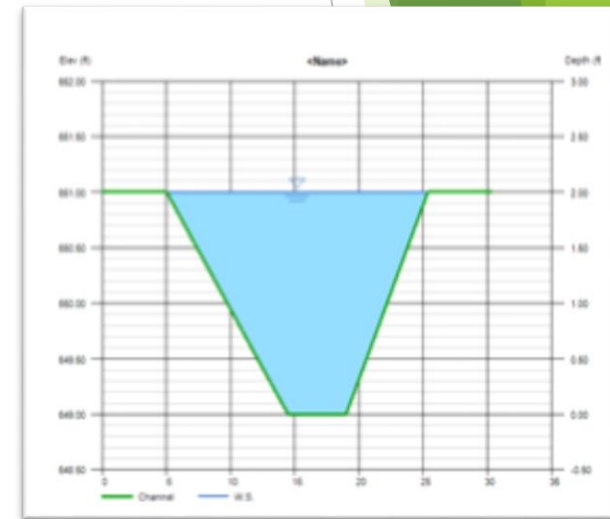
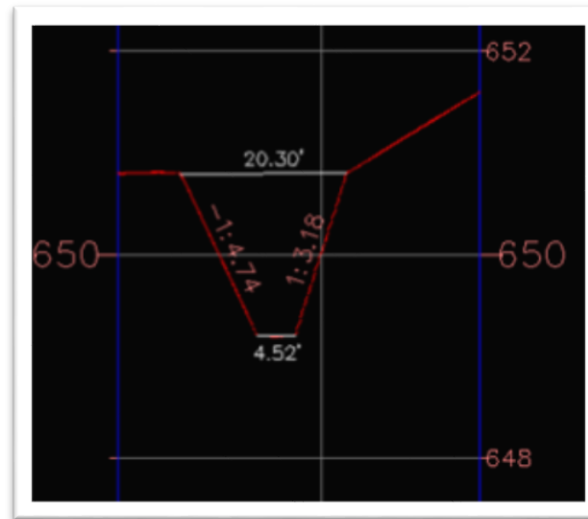
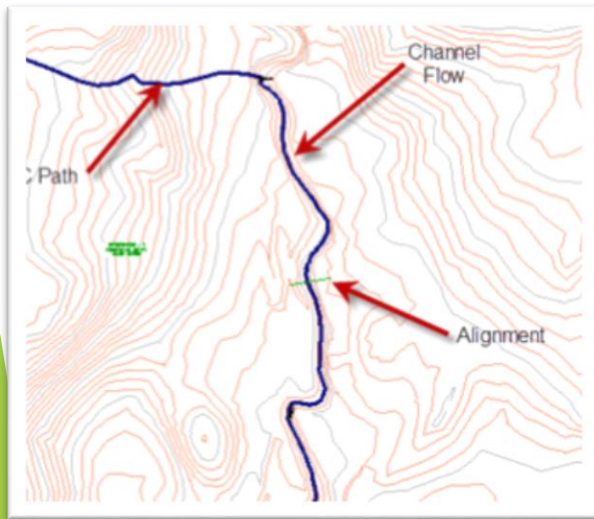
- ▶ Low Water Crossing Designs
- ▶ Techniques to Armor Existing Crossing



The large rocks are piled on the banks to prevent soil erosion

Scope (Analysis and Design)

- ▶ AutoCAD
- ▶ Hydraflow Express
- ▶ Bentley WaterGEMS
- ▶ Culvert Master

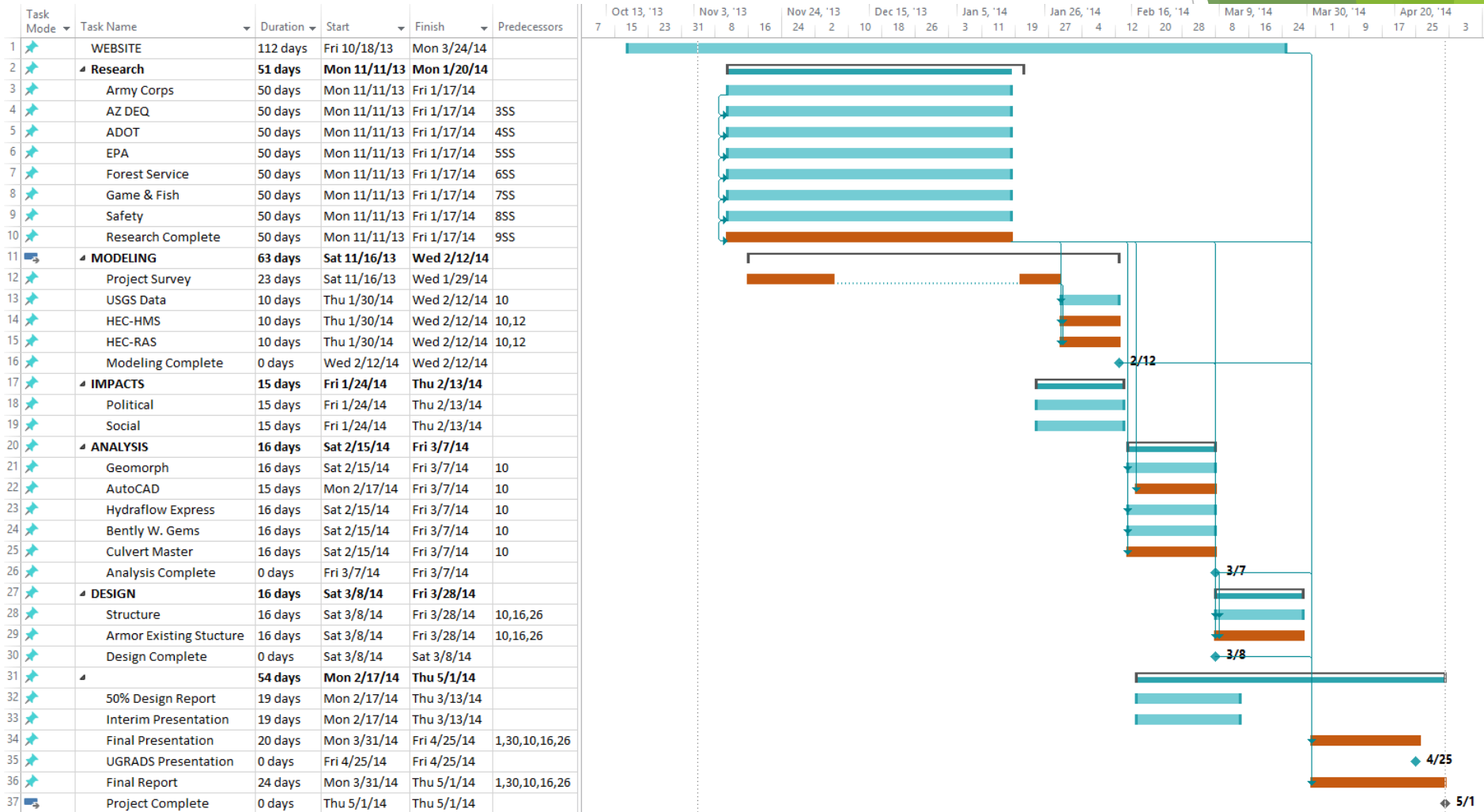


Scope (Exclusions)

- ▶ Geotechnical Evaluation
- ▶ Traffic Control
- ▶ Structural Design



Schedule



Schedule showing Critical Path in dark orange

Hours Worked Estimate

- Hours assigned per subject per task
- Task hours totaled

	Senior Engineer	Engineer	Intern	Administrative
Research				
Army Corps	1.5	4	5	0.5
AZDEQ	1.5	4	5	0.5
ADOT	1.5	4	5	0.5
EPA	1.5	4	5	0.5
Forest Service	1.5	4	5	0.5
Game & Fish	1.5	4	5	0.5
Safety	1.5	4	5	0.5
Total	10.5	28	35	3.5

Complete Estimated Hours per Task per Role				
	Senior Engineer	Engineer	Intern	Administrative
Research				
Army Corps	1.5	4	5	0.5
AZDEQ	1.5	4	5	0.5
ADOT	1.5	4	5	0.5
EPA	1.5	4	5	0.5
Forest Service	1.5	4	5	0.5
Game & Fish	1.5	4	5	0.5
Safety	1.5	4	5	0.5
Total	10.5	28	35	3.5
Modeling				
HEC-HMS	2	7	7	0
HEC-RAS	2	7	7	0
USGS DATA	2	7	7	0
Land Survey	8	20	20	0
Total	14	41	41	0
Impact				
Political	0.5	0.5	2	3
Social	0.5	0.5	2	3
Total	1	1	4	6
Analysis				
AutoCAD 3D	4	8	8	0.5
Geomorphology	4	8	8	0.5
Culvert Master	4	8	8	0.5
Hydraflow Express	4	8	8	0.5
Bentley W. Gems	4	8	8	0.5
Documentation	2	8	8	8
Total	22	48	48	10.5
Design				
Structure	4	11	11	0
Armoring Exist.	4	11	11	0
Documentation	2	10	10	2
Total	10	32	32	2

Cost Estimate

1.0 Personnel					
Tasks	Senior Engineer	Engineer	Intern	Administrative	Total Per Task (hrs)
Research (hrs)	10.5	28	35	3.5	77
Modeling (hrs)	14	41	41	0	96
Impact (hrs)	1	1	4	6	12
Analysis (hrs)	22	48	48	10.5	128.5
Design (hrs)	10	32	32	2	76
Total Per Role (hrs)	57.5	150	160	22	389.5
<i>Pay Scale Per Role</i>	\$ 170.00	\$ 90.00	\$ 30.00	\$ 45.00	
Cost	\$ 9,775.00	\$ 13,500.00	\$ 4,800.00	\$ 990.00	\$ 29,065.00
Total Personnel Cost	\$ 29,000.00				
2.0 Reimbursement					
Not to exceed	\$ 1,000.00				
3.0 Subcontracts					
Structural Analysis	\$ 15,000.00				
Geotechnical Analysis	\$ 15,000.00				
Total Subcontracts	\$ 30,000.00				
4.0 Total Service Cost	\$ 60,000.00				
5.0 Comparison					
	Clients Budget				
	\$ 80,000.00	>	\$ 60,000.00		
Remaining Budget	\$ 20,000.00				

Budget Comparison

<u>5.0 Comparison</u>	Clients Budget		
	\$ 80,000.00	>	\$ 60,000.00
Remaining Budget	\$ 20,000.00		

- ▶ The budget allocated by Property Association
- ▶ Services are within budget

Conclusion

- ▶ Armoring Current Crossing
- ▶ New Crossing Design
- ▶ Thorough Analysis
- ▶ Below Budget