COLORADO
Department of Transportation

SCOPE OF WORK (SOW)
UNDERWATER INSPECTION OF ON-SYSTEM AND OFF-SYSTEM BRIDGES
Colorado Department of Transportation

I. Introduction

The goal of this project is to update the National Bridge Inventory (NBI) through underwater inspection of bridges owned by local governments (cities and counties) or the state of Colorado, and to inform the bridge owners and the Colorado Department of Transportation (CDOT) of the conditions of the bridges. The local agencies and state of Colorado will be referred to as the "owner" hereinafter in this Scope.

The purpose of this agreement is to conduct underwater bridge inspections in accordance with the requirements of the National Bridge Inspection Standards (NBIS) and to report the findings to the state and to the owner. The inspections shall be referred to as "the work" henceforth in this scope.

II. Project

Underwater Bridge Inspection for approximately 50 On-System bridges, statewide. Two and possibly three bridges require an on-site recompression chamber.

Underwater Bridge Inspection for approximately 45 Off-System bridges, statewide.

Special and emergency underwater inspections as required throughout the length of the Contract.

III. Location and Description

The On-System portion of the project consists of approximately 50 bridges, listed on the attached Exhibit A1, located on State Highways throughout the State. These bridges are owned and maintained by the State.

The Off-System portion of the project consists of approximately 45 bridges, listed on attached Exhibits A2 and A3, located in Counties and Cities throughout the State. These bridges are owned and maintained by the local entities.

Exhibits A1, A2, and A3 are provided for information only. Specific structures to be inspected will be listed in the individual task orders.

IV. Scope of Work

All work performed under this contract shall be in accordance with the National Bridge Inspection Standards, the Manual for Maintenance Inspection of Bridges issued by

AASHTO and other documents as defined by individual task orders. All diving operations shall be conducted in conformance with the requirements of Subpart T, Commercial Diving Operations, Occupational Safety and Health Administration Standards and any other requirements governing such activities. The Consultant shall supply all equipment, labor, licenses, permits, and insurance necessary for the completion of the work.

The Contract Administrator for the work is:

Michael Collins P.E.
Bridge Engineer
Colorado Department of Transportation
2829 W. Howard Pl.
Denver, Colorado 80204
(303) 757-9309

The bridge inspection engineer for the work is:

Lynn E. Croswell, P.E.
Bridge Inspection Engineer
Colorado Department of Transportation
2829 W. Howard Pl.
Denver, Colorado 80204
(303) 757-9188

Project management activities will be coordinated by:

Anthony Macias, CEPM II
Colorado Department of Transportation
2829 W. Howard Pl.
Denver, Colorado 80204
(303) 757-9226

Coordination may be required with the following:

Cities
Counties
Railroads
Regional Transportation District
Corps of Engineers
Urban Drainage & Flood Control District (UD & FCD)
Federal Emergency Management Agency (FEMA)

V. Underwater Inspection

A. The Consultant shall perform a thorough visual and tactile inspection of those piers and abutments more than 3' below the waterline, as authorized by the CDOT representative, of each structure listed in the individual task orders. All piers in the channel with a water depth less than 3' or "dry condition" at the time of inspection shall be visually inspected. The Consultant shall identify quantities and deficiencies for all inspected substructure and foundation elements in accordance with the current edition of the Manual for Bridge Element Inspection. The consultant shall also determine the need for any in-depth inspections that may be required as a result of suspected deficiencies that cannot be identified by visual/tactile inspection.

In addition, inspections shall be performed in accordance with the following references:

- Bridge Inspection Reference Manual (BIRM) -2018 (revision in 2011)
- Colorado Coding Guide (in revision)
- Recording and Coding Guide for Structure Inventory and Appraisal of the Nations Bridges – 1995
- Hydraulic Engineering Circular No:18 (HEC18) -2012
- Other references as specified in the individual task orders

B. Cleaning

Ten percent of the structure elements shall be well cleaned of any marine growth or other material obstructing detailed inspection to facilitate the inspection. This percentage may vary as directed by the CDOT Project Manager. Piles shall be cleaned in bands approximately one foot wide at the waterline, mud line and mid-height. Piers and abutments shall have one foot square areas cleaned at the nose, sides and tail at the waterline, mud line and mid-height. In-depth investigations are not part of this contract. Once identified, a separate contract may be developed to address these needs.

C. General Element Inspection Description

The inspection of substructure and foundation elements shall extend from the waterline to the mud line and include, but not be limited to the following:

1. Concrete Pile and/or solid Piers: Check all concrete for erosion, wear, abrasion, scaling, spalling, exposure and deterioration of any exposed reinforcing steel, and all cracking.

2. Steel Pile and/or Steel Encased Piers: Check all steel for corrosion, misalignment, and loss of section.

3. Timber Pile: Check all timber for vermin such as marine borer, shipworm attack, termites, and powder-post beetles, etc.; for evidence of fungus decay;

for damage by collision or over stressing; and for excessive weathering. All timber shall be sounded and probed with a heavy-duty 6 inch (min.) blade ice pick or awl.

D. Blue Mesa Reservoir Bridges

1. Structures K-06-A and K-07-B: Inspect all concrete surfaces for cracks, discoloration, deformation, scaling and delamination, which could affect structural soundness. Inspect submerged riprap, fills, and foundations for signs of displacement or erosion. See Attachment 1 for additional information concerning these bridges.

   Inspection of rock bolt area and integrity testing of bolts (one location only at Str. K-07-B, Pier 7). The rock bolts shall be tested by striking the bolt end and retainer plate with a hammer. Other methods may be considered, but must be approved by the CDOT Project Manager. At least 25 percent of the rock bolts shall be tested from a representative sample of the 55 foot vertical by 60 foot horizontal rock bolted area. The plans for Str. K-07-B indicate that 5,000 linear feet of rock bolts of an unknown length were installed in a 48'V x 34'H area. The bolt pattern is irregular. Each bolt inspected shall to be tagged with the underwater inspection date to assist in future location and categorizing of tested bolts.

   Provisions shall be made to accommodate CDOT and Federal Highway Administration (FHWA) personnel during the inspections. No underwater diving provisions need to be made for CDOT or FHWA personnel.

   THESE TWO BRIDGES REQUIRE AN ON-SITE RECOMPRESSION CHAMBER

2. The Engineer in charge of the inspections shall supply a Daily Diving Report to the CDOT Project Manager via email or other format as approved by the CDOT Project Manager. This report should include a brief summary of which bridges and substructure units were inspected that day.

E. Sounding Measurement and Channel Profile data.

Depth soundings and channel profile survey shall be collected between 200' upstream and 200' downstream. Enough data should be collected to generate an accurate channel and topographical profile. At a minimum, depth soundings shall be taken around each pier, along the fascia, and at 100' and 200' intervals upstream and downstream. Channel profile or sounding measurements shall be obtained using echo sounding, sonar, or hydrographic survey technology unless water conditions preclude the use of a boat, in which case sounding poles or lead lines may be utilized. Elevations shall be referenced to the brass cap located on the bridge or other point of

known elevation, such as a bridge seat if a brass cap is not present and shall be identified on the Channel Profile sheet.

The channel bottom, particularly around piers and abutments, shall be probed and the presence, size and condition of any riprap shall be noted.

F. Photographs and Imagery:

1. Digital color photography shall be utilized to document underwater conditions. A "clear water" box shall be available on site for use if needed to secure photographs. The following site photographs shall be taken at a minimum:

    - View upstream
    - View downstream
    - Typical pier (for each representative pier configuration inspected)
    - Bridge Elevation upstream
    - Bridge Elevation downstream
    - Both Embankments under the bridge
    - All CS3 and CS4 deficiencies
    - Arial photography may be used if approved by the CDOT Project Manager

2. Underwater sonar imaging and 3-D laser scanning techniques may be required at the Blue Mesa Reservoir structure piers as requested by the CDOT Project Manager.

G. Scour and Undermining

All exposed footings need to be recorded and documented. Measurements need to be obtained for all toe exposure height and undermining. Pile sizes, configuration, and lengths need to be taken for all exposed piles. Information should be sufficient for use in a structural or scour analysis if requested by CDOT. Coding and inspection shall be in accordance with NBIS and HEC 18 Manual. All scour cones and holes should be described using a radius and depth.

H. Dangerous or Critical Situation

If a dangerous or critical situation exists, in the opinion of the Inspection Team Leader, the CDOT Project Manager and the Bridge Inspection Engineer shall immediately be notified of the situation and follow up with a written report of the incident.

VI. Schedule

The Consultant shall submit a proposed schedule of inspections to the CDOT Project Manager at least five days prior to commencement of inspection work. The Consultant shall also inform the State of any changes to the proposed schedule. Schedules will be as specified in the individual task orders.

VII. Personnel

Detailed resumes of each inspection team member shall be submitted to the CDOT Project Manager for approval prior to beginning work.

Qualifications of inspection personnel shall conform to the requirements of the NBIS and the following:

A. The Engineer in charge of the inspections and in responsible charge of the preparation of the inspection reports must possess a Colorado Professional Engineer license.

B. The Team Leader must meet the following requirements:

1. Have a minimum of five years of experience in underwater structure inspection assignments in a responsible capacity.
2. Meet the qualifications of a bridge inspector and underwater bridge inspector in accordance with the NBIS requirements.
3. Be certified by the Association of Diving Contractors International (ADCI) as a surface supplied air diver.

C. The Diver must meet the following requirements:

1. Have a minimum of two years of experience in underwater structure inspection.
2. Meet the qualifications of an underwater bridge inspector in accordance with the NBIS requirements.
3. Be certified by the Association of Diving Contractors International (ADCI) as a surface supplied air diver.

VIII. Deliverables

All deliverables shall be submitted in electronic format. Deliverables will include a separate standalone final report for each bridge, input of all data into AASHTOWare Bridge Management software (BrM) and electronic files used to create the standalone report.

The standalone final report must meet the following requirements:

- The report must be sealed by the engineer of record and signed by the team leader.
- The report shall include the minimum photograph requirements documenting the site (as described above).
- Description of the condition of the bridge units inspected.
- Appropriate element coding for each element below the waterline.
- Fascia sounding measurements, and a channel profile/contour drawing (as described above). Plots should include both an elevation and plan view of the bridge channel (both depths & elevations shall be included when possible). The fascia profile measurements must be included in a separate table in the report for comparison during a high flow event.
- Underwater Procedures in accordance with "Metrics for the Oversite of the National Bridge Inspection Program" May 2017. Any special access notes required for performing the underwater inspection must be included.
- Recommendations for repairs or further investigations shall be included as appropriate.
- Coding for all deficiencies and quantities on all elements inspected below the waterline.

Electronic seed file submittal shall include the following at a minimum:

- .DGN or .DWG files used to create the profiles and contours for the channel
- All excel files used to create the report

IX. Insurance

Before starting work, the Firm shall submit evidence of the required insurance coverage as specified in the contract.

X. Method of Payment

These contracts will be paid for on a cost plus fixed fee basis. The consulting firm will bill for their actual costs, using the negotiated rates, incurred while performing the work. Consultants will bill monthly and include a project status update with each billing.

XI. Duration of Work

The work shall commence on the date specified in the notice to proceed and shall be completed as specified in the individual task orders.

Special and emergency underwater inspections will be conducted under separate task orders, when and if needed, through the end of the contract.

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EXHIBIT A1
ON-SYSTEM BRIDGES

HWY	M.P.	STR. #	COUNTY	FEATURE	SSU Insp in 2016	MAX/ MIN DPTH	Tot # SSU's
6	43.26	H-03-E	MESA	COLO RIV	2, 3, 4	6'/4'	6
13	0.18	F-05-R	GARFIELD	COLO RIV	2, 3, 4, 5	14'/4'	6
13	85.84	C-06-D	MOFFAT	YAMPA RIV	S.V.		
25	254.84	C-17-G	LARIMER	DRAW	1, 2, 3, 4	6'/1'	4
40	105.47	C-07-A	ROUTT	YAMPA RIV	2, 3, 4	8'/1'	5
40	113.40	C-08-W	ROUTT	YAMPA RIV	2	9'/0'	3
45	5.38	K-18-EP	PUEBLO	ARKANSAS	3	6'/0'	4
50	70.52	I-04-K	DELTA	GUNNISION RIV	3,4	5'/4'	5
50	32.42	H-02-CA	MESA	COLO RIV	5, 6, 7	12'/3'	9
50	32.43	H-02-DZ	MESA	COLO RIV	5, 6, 7	11'/5'	9
53	1.33	E-17-IR	ADAMS	CLEAR CREEK	2	6'/0'	3
64	17.51	D-01-E	RIO BLANCO	WHITE RIV	3, 4	9'/5'	4
70	16.76	H-01-AE	MESA	N. CHAN COLO R.	2, 3	4'/0'	4
70	16.77	H-01-AD	MESA	N. CHAN COLO R.	2, 3	3'/1'	4
70	17.33	H-01-AB	MESA	N. CHAN COLO R.	2	8'/2'	4
70	17.34	H-01-AC	MESA	N. CHAN COLO R.	2, 3	5'/4'	4
70	49.99	H-03-BR	MESA	COLO RIV	2, 3, 4, 5, 6, 7, 8	11'/3'	9
70	50.01	H-03-BS	MESA	COLO RIV	2, 3, 4, 5, 6, 7, 8	11'/6'	9
70	50.50	H-03-BQ	MESA	COLO RIV	2, 6	10'/6'	9
70	50.51	H-03-BP	MESA	COLO RIV	2, 6, 7	15'/3'	9
70	56.99	G-03-P	MESA	COLO RIV	2, 3, 4	7'/4'	5
70	62.89	G-04-AA	MESA	COLO RIV	2, 3, 4	13'/4'	5
70	66.90	G-04-AB	MESA	COLO RIV	2, 3, 4	7'/1'	5
70	87.50	F-06-M	GARFIELD	COLO RIV			
70	88.57	F-05-K	GARFIELD	COLO RIV	2, 3, 4, 5	9'/1'	6
70	88.58	F-05-L	GARFIELD	COLO RIV	3, 4, 5	12'/4'	6
70	96.35	F-06-Y	GARFIELD	COLO RIV	2, 3	9'/5'	6
70	96.36	F-06-Z	GARFIELD	COLO RIV	2, 3, 4	8'/2'	6
70	126.94	F-08-BD	GARFIELD	COLO RIV	3, 4, 5	14'/11'	6
70	125.78	F-08-AR	GARFIELD	COLO RIV	2, 3, 4	11'/8'	8
70	125.79	F-08-AS	GARFIELD	COLO RIV	3	4'/0'	5
92	6.42	I-05-V	DELTA	GUNNISON RIV	2, 3	8'/6'	4
141	88.42	K-01-A	MONTROSE	DOLORES RIV	3, 4	7'/0'	5
141	153.65	I-03-A	MESA	GUNNISION RIV	3, 4, 5	10'/5'	6
141	159.44	H-03-BL	MESA	COLO RIV	2, 3	7'/6'	4
287	344.79	B-16-H	LARIMER	SPRING CK	1, 2	6'/4'	2
318	54.86	B-04-D	MOFFAT	YAMPA RIV	2, 3, 4	4'/3'	5
340	1.43	H-02-GA	MESA	COLO RIV	2, 3, 4, 5, 6	6'/4'	8
340	12.60	H-02-S	MESA	COLO RIV	7, 8, 9	12'/6'	11

340	12.29	H-02-R	MESA	REDLANDS CANAL	1, 2	8’/7’	2
340	12.29	H-02-GB	MESA	REDLANDS CANAL	1, 2	4’/0’	2
340	12.61	H-02-GC	MESA	COLO RIV	7, 8, 9	8'/5’	11
550	21.93	O-05-J	LA PLATA	ANIMAS RVR	1, 2, 3, 4	8’/3’	4

43 Bridges Total No. SSU inspected in 2016 = 114

(S.V. = Site Visit Only at time of 2016 inspection)

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EXHIBIT A2
OFF-SYSTEM COUNTY BRIDGES

STR. #	COUNTY	FEATURE	SSU Insp in 2016	MAX/ MIN DPTH	Tot # SSU's
ADA124-9.848	ADAMS	S. PLATTE RIV	2, 3, 4	5'/4'	5
ADA097-07.4N048	ADAMS	S. PLATTE RIV	2, 3	6'/1'	4
DEL2200R-120-44A	DELTA	GUNNISON RIV	2, 3	5'/2'	4
DEL65OR-2.8-35A	DELTA	GUNNISON RIV			
CHA191-01.57	CHAFFEE	ARKANSAS RIV	1, 2	4'/2'	3
EAG-301-15.6A	EAGLE	COLO RIV	S.V	4'/2'	5
EAG-301-23.5A	EAGLE	COLO RIV	2, 3	2'/0'	4
EAG-301-27.7A	EAGLE	COLO RIV	2, 3	5'/0'	4
EAG-028-03.6A	EAGLE	COLO RIV	2	5'/0'	3
GAR323-01.43	GARFIELD	COLO RIV	2	9'/0'	3
GAR301-00.71	GARFIELD	COLO RIV	2, 3	15'/7'	4
GAR300-00.80	GARFIELD	COLO RIV	2	9'/0'	3
GAR109-01.44	GARFIELD	ROARING FK RIV	2	6'/0'	3
GAR311-12.69	GARFIELD	COLO RIV	2	7'/0'	3
GAR311-12.54-A	GARFIELD	COLO RIV	1, 2	11'/0'	2
049001100.1005A	GRAND	COLO RIV	2, 3	5'/3'	4
067032200.40036	LA PLATA	LOS PINOS RIV	1, 2	5'/3'	3
LR13E-0.3-24E	LARIMER	LOVE CANAL	1, 2, 3	4'/4'	3
LOG7.4-36.8-1	LOGAN	PAWNEE CREEK	2, 3	8/6'	4
LOG29.5-12.551A	LOGAN	S. PLATTE RIV	2	12'/0'	3
MESA-G.8-39.1	MESA	COLO RIV	2, 3, 4, 5	6'/3'	6
MESA-V.5-45.3A	MESA	COLO RIV	2, 3, 4	8'/4'	5
MESA-I.9-39.4A	MESA	COLO RIV	2, 3	7'/2'	4
MOF17-13.35	MOFFAT	YAMPA RIV	2	5'/0'	3
MOF19-01.19	MOFFAT	YAMPA RIV	2	5'/0'	3
MOF53-08.35-A	MOFFAT	YAMPA RIV	2	5'/0'	3
MG3-1.0-Y.5	MORGAN	INLET CANAL	2	5'/0'	3
RIOB-077-00.49	RIO BLANCO	WHITE RIV	2, 3	7'/5'	3
RIOB-202-00.21	RIO BLANCO	WHITE RIV	2, 3	8'/2'	4
RGDN05-05.00W	RIO GRANDE	RIO GRAND RIV	1, 2, 3	5'/5'	3
107017900.80903	ROUTT	YAMPA RIV	2, 3	6'/3'	4
107020500.30902	ROUTT	YAMPA RIV	2, 3	14'/0	4
WEL 035.0-062.0A	WELD	POUDRE RIV	1, 2	8'/7'	3
WEL 029.0-062.0B	WELD	POUDRE RIV	2	6'/0'	3
WEL087.0_042.5B	WELD	JACKSON LK INLET			

35 Bridges Total No. SSU inspected in 2016 = 59

(S.V. = Site Visit Only)

COLORADO
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EXHIBIT A3
Provided for information only
COLORADO DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION
OFF-SYSTEM CITY BRIDGES

STR. #	CITY	FEATURE	SSU Insp in 2016	MAX/ MIN DPTH	Tot # SSU's
BOLD-39-N63RD-A	BOULDER	FEEDER DITCH	1, 2, 3	8'/8'	3
GLNWD-DEVEREU	GARFIELD	COLO RIV	2, 3	7'/5'	4
GRJ-23.08-E.76	GRAND JUNCTION	COLO RIV	2, 3, 4	11'/2'	7
D-02-PR-150	DENVER	S. PLATTE RIV	S.V.	3'/1'	4
GLNWD-27TH ST	GLENWOOD SPG	ROARING FK RIV	2, 3	5'/0'	4
PUEMAL-0.1-MALL	PUEBLO	UNNAMED DRAIN	1, 2, 3	4'/3'	3
SALOOF-00.95	CHAFFEE	ARKANSAS RIV	2	4'/0'	3
TNTH5-0.9-36-A	TIMNATH	CACHE LA POUDRE	2	4'/0'	3

8 Bridges

Total No. SSU inspected in 2016 = 15

(S.V. = Site Visit Only)

COLORADO
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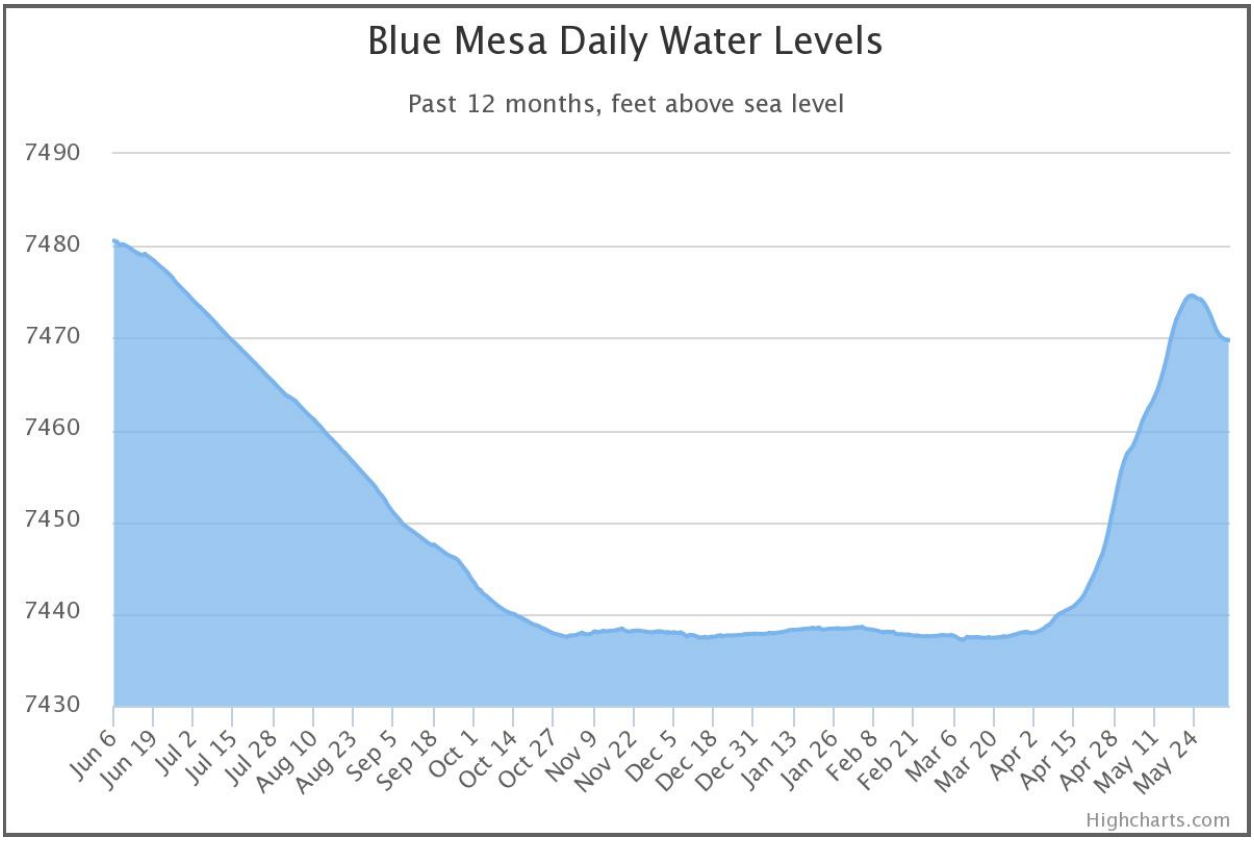
ATTACHMENT 1
Provided for information only
BLUE MESA RESERVOIR WATER ELEVATIONS & MISC. INFORMATION



Data from http://bluemesa.water-data.com/

In 2016, a total of 13 piers for these bridges required diving.

The plans for the project that constructed the bridges, Project No. CC 40-0006-26, indicate the approximate groundline elevations of those piers to be as follows:

Str. K-07-A	Str. K-07-B		
Pier 3 7461	Pier 3 7461	Pier 6 7370	Pier 9 7458
Pier 4 7375	Pier 4 7431	Pier 7 7437	
Pier 5 7422	Pier 5 7409	Pier 8 7456	

Str. K-08-C
Pier 3 7461
Pier 4 7461

The lowest elevation of the rock bolts at Pier 7 is approximately 7332+/-. The maximum dive at low water is about 140'.

Ice is off the water about April 1st to the 15th of each year to allow access to the piers.

Str. K-07-A and K-07-B are located in Gunnison County on US 50 at M.P. 132.72 and 136.19 respectively. K-07-A spans the Lake Fork of the Gunnison River and Str. K-07-B spans the Gunnison River. Structure K-08-C is located on S.H. 149 at M.P. 117.39 and spans the Gunnison River where it leaves Blue Mesa Reservoir.