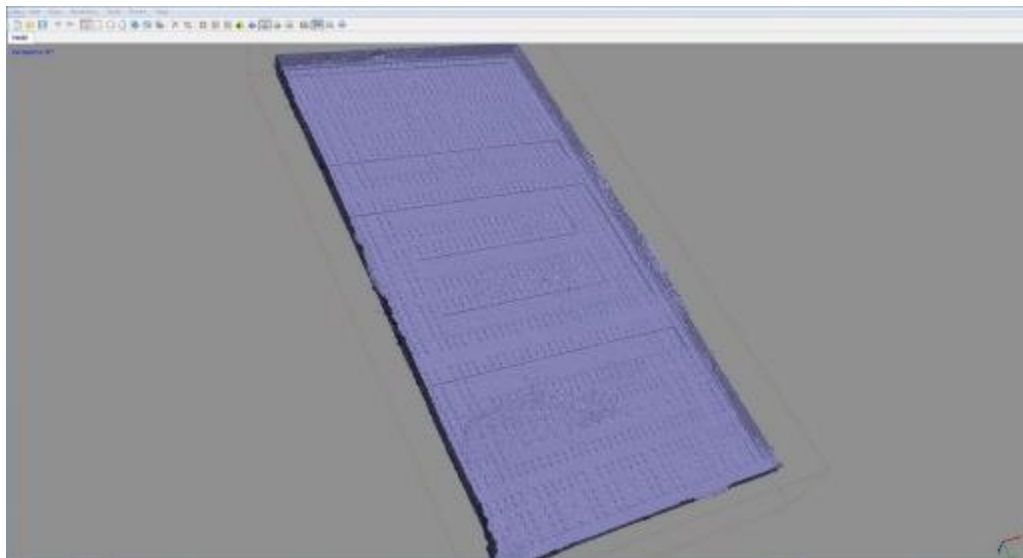


RECLAMATION

Managing Water in the West

Photogrammetric Processing from Remotely Operated Vehicle (ROV) Data: Trinity Dam Intake Tunnel

**Technical Memorandum No. 8530-2016-31
Research and Development Office
Science and Technology Program
(Final Report) ST-2016-7738-01**



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Bureau of Reclamation
Research and Development Office

September 2016

Mission Statements

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Acronyms and Abbreviations

@	at
3D	three dimensional
CGSL	Concrete, Geotechnical and Structural Laboratory
CL	centerline
CVP	Central Valley Project
Cyl.	cylinder
dia.	diameter
El.	Elevation
EOP	electro-osmotic pulse
ft	feet
FWG	fixed wheel gate
HD	high definition
HPU	hydraulic power unit
hr.	hour
lbs.	pounds
LED	light emitting diode
LIDAR	light detecting and ranging
min.	minimum
mins.	minutes
max	maximum
MP	megapixel
MW	megawatt
NCAO	North California Area Office
NTU	Nephelometric Turbidity Unit
ROV	remotely operated vehicle
S&T	Science and Technology
SIFT	scale-invariant feature transform
SOW	statement of work
sta.	station
Std.	standard
UAS	unmanned aerial vehicle
W.S.	water surface

Executive Summary

In 2014, the Reclamation Research Science and Technology (S&T) program funded an investigation to see if an underwater remotely operated vehicle (ROV) could be used to capture quality photogrammetric data. This project was a joint effort between the North California Area Office (NCAO) and the Concrete, Geotechnical and Structures Laboratory (CGSL) in Denver. In October 2015, the data was collected in conjunction with a mechanical refurbishment project in the intake structure at Trinity Dam near Redding, California. In addition to collecting photogrammetric data, the ROV also provided a complete high definition (HD) video inspection and 3D laser scanning of high risk deterioration areas. The photogrammetric processing was performed at the CGSL as a part of its Remote Three Dimension Condition Assessment Program.

The results of the inspection showed that no major deterioration had taken place in the last 60 years that the structure has been in service. Noted defects in the concrete were generally attributed to poor construction practices and quality control: honeycombing, bug holes, poor consolidation, unfilled tie bolt holes, etc. There were no major cracks or spalls noted. The condition of the steel mechanical equipment was satisfactory with minor corrosion and no major loss of section. Because the fixed wheel gate was in the “up” position, the gate seals were inspected as well – no issues were noted. The hemispherical bulkhead seal was covered in a thick layer of silt but the ROV pushed most of it off. A small diameter (~3/16 inch) wire rope was found draped over the seal.

The water quality and lighting only allowed viewing of the gate about 3- 4 foot wide at a time. Photogrammetry was used to reconstruct the entire upstream face of the fixed wheel gate. The model was used to generate a high resolution orthophoto mosaic to allow an inspection of the entire face of the 10 foot wide by 20 foot tall gate. Underwater laser scanning was also performed on the upstream face of the fixed wheel gate and the bulkhead seal to help assess section loss.

The entire structure that was inspected was about 1,700 feet long and between 16 feet and 28 feet in diameter. Most of the structure was about 200 feet underwater. This project would have been impossible without a long range ROV and demonstrated their usefulness to Reclamation. Divers would have been unable to dive as deep and there would be concerns about working in the intake structure. If the structure were able to be dewatered, the nearly 150 foot tall vertical section would require specialized rope access teams to be inspected.

Finally, this research, inspection and photogrammetric 3D modeling has the potential to reduce costs associated with uncertainty in repair and maintenance estimates. By deploying long range ROV's to assist with underwater inspections and evaluations, unknown conditions do not have to be assumed and the correct solutions can be chosen before the structure is dewatered.

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Background

The purpose of this research was to determine if a digital 3D model could be generated from data collected using sensors onboard an underwater remotely operated vehicle or ROV. Optimal photogrammetry data is collected above water using high resolution cameras with large sensors. However, recent advancements in camera technology to improve the quality of the image combined with algorithms to reduce error within the photogrammetry software have the capacity to perform photogrammetric processing from alternative sources such as high definition (HD) video frames.

ROV's have the ability to carry an indefinite set of sensors for different types of data collection because they are connected to a power source via a tether. At Reclamation, the most used sensors on an ROV are video and still image cameras. Reclamation has sonar capabilities but these are not carried on an ROV. Commercial available ROV 3D data collection services includes 3D sonar and laser scanning or other types of laser measurement such as LIDAR. 3D sonar can be performed in low light and low water quality but the resolution of a sonar scan is much lower than light based scans. Laser scans are also limited by the water quality but can be operated in low light conditions. Underwater photogrammetry is used less because it requires light and clear water.

Trinity Dam is located in the southernmost part of the Cascade mountain range in north central California about 25 miles northwest of Redding. The dam is one of the first water control structures on the Central Valley Project, holding back water to feed into its 500 miles of canals. Because of its placement in the mountains, the reservoir collects mainly snow melt and the water is nearly crystal clear. The earthen structure was built between 1957 and 1962 and is just over 500 feet tall. A 140 MW powerplant is located downstream and is feed by an approximately 1300 foot long 16 foot diameter penstock. The flow through the penstock is controlled by a 10 foot wide by 20 foot tall fixed wheel gate located within the dam. Water is diverted from the reservoir through a concrete intake structure.

The intake structure consist of three parts: a 125 foot tall by 23 foot diameter trash rack structure, a 150 foot tall by 16 foot diameter vertical section directly below the trash rack structure and a 1,500 foot long by 28 foot diameter horizontal section as shown in Figures 1 and 2. The intake structure is usually covered by about 125 ± 25 feet of water but in recent years has been exposed in the autumn and winter seasons due to decreased snow fall and drought conditions throughout California. A hemispherical bulkhead is stored in the top of the trash rack structure. A bronze seal is embedded in the concrete at the bottom of the trash rack structure. The bulkhead can be lowered to the bronze seal to plug the vertical and horizontal portions of the intake structure and allow dewatering of the structure. The bulkhead has not been inspected or used since the dam was built nearly 60 years ago.

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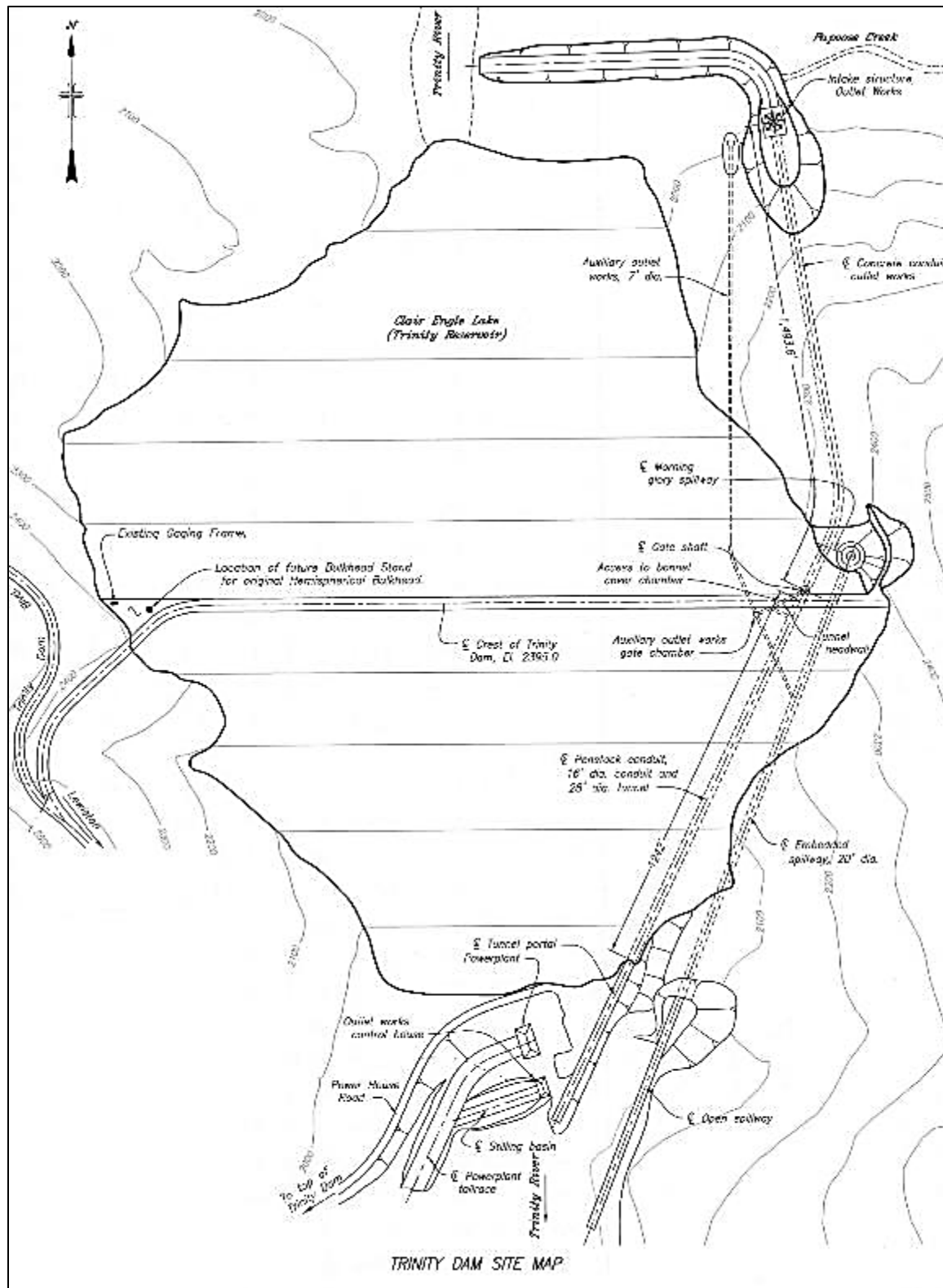


Figure 1: Trinity Dam Site Map

Photogrammetric Processing from Remotely Operated Vehicle (ROV) Data: Trinity Dam Intake Tunnel

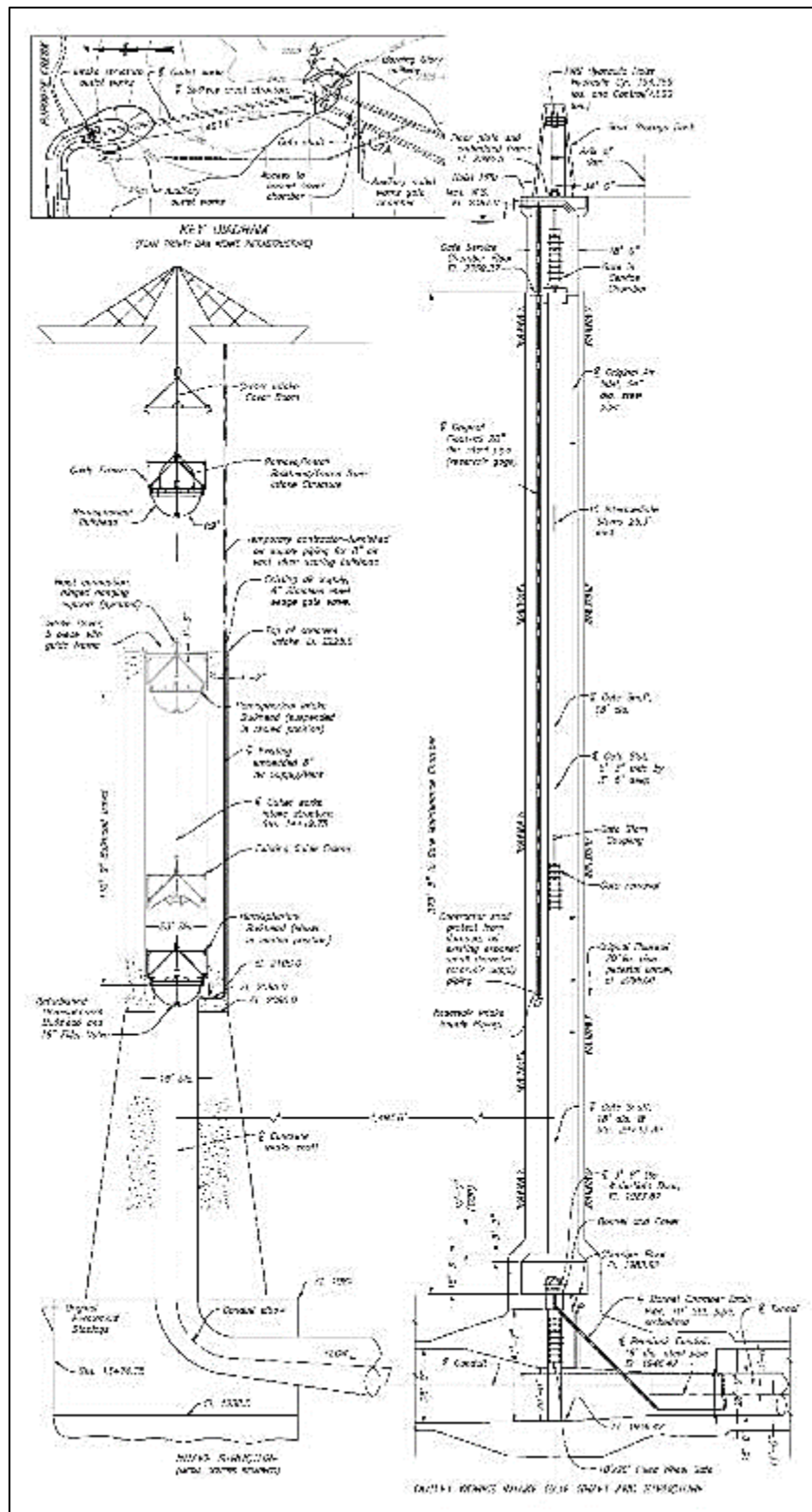


Figure 2: Intake Structure Elevation View

Over the past few years, Reclamation has been planning to rehabilitate several mechanical components at Trinity Dam including the hemispherical bulkhead and fixed wheel gate. Part of the rehabilitation project also included addressing any potential deterioration within the concrete intake structure. The initial plan consisted of lowering the bulkhead and dewatering the intake structure to allow inspection and repair of any defects that would be found. There were several issues with this approach: 1) the condition of the bulkhead seal was unknown and may not seal adequately with the bulkhead, 2) the 150 foot tall vertical section would require scaffolding or complicated rope access, 3) dam operations limit the time that the intake structure can be dewatered so repair may have to be done in stages requiring an indefinite schedule, and 4) because of the unknown conditions, the cost estimates for this stage of the project were highly speculative. A potential solution for the problem was proposed by using a long range ROV.

There were several concerns with using an ROV. Previous Reclamation experience with ROV's included short range distances (< 500 feet) and low resolution video resulting in less than optimal inspection equipment. Access to the intake structure would need to be provided since there isn't an ROV access point like many other Reclamation facilities. The proposed ROV would need long range capability to reach the fixed wheel gate – at least 1,700 feet. It would need at a minimum 1080 lines of vertical resolution from the video. The inspection would require that every part of the structure would be thoroughly investigated to be sure to capture any possible deterioration. If deterioration were to be found, it would need to be measured to estimate quantities needed for repair.

Because of the unknowns with respect to the ROV and the data collected from it, project personnel felt that the risk and costs were greater than the benefit. However, the idea was proposed to the Reclamation Research Science and Technology program and the project was approved. In addition, support from the North California Area Office was provided. The purpose of the research was to determine if data collected from an ROV could be used to create a 3D model that could supplement an underwater condition assessment.

Project Management Notes

The project was initially begun in the spring of 2014 and scheduled to be completed by midyear 2015 but contracting and weather delays resulted in an initial termination of the project. The scope of the research project was altered to provide photogrammetric processing of Elephant Butte Dam using unmanned aerial system (UAS) data [1]. However, forecasts of the Trinity Reservoir elevations predicted another exposure of the intake structure during the fall and winter of 2015, so the contracting was resumed. The scope of the research project was increased to cover work for both projects. The data collection for Trinity was performed in the fall of 2015. The photogrammetric processing was conducted during the winter of 2016.

Procedure

The project was divided into several parts: scope, scheduling, data collection, data processing, analysis. Scope referred to the development of the specifications that would be required of the contractor. Collaboration with the contractor and timing the data collection to coincide with the proper site conditions were included in the scheduling. Data collection and inspection referred to the time the contractor was on-site operating the ROV and sensors. Data processing was done at Reclamation to prepare the data for photogrammetric analysis. Photogrammetric analysis produced the 3D model.

Scope

A statement of work (SOW) was developed for the contract specifications that described the expected requirements from the contractor. The SOW specified the use of an ROV to perform an underwater inspection of the interior and exterior intake structure from the submerged portion of the trash rack structure to the upstream face of the fixed wheeled gate. There were 10 tasks for the contractor to perform in the contract. Table 1 summarizes the number, title and items belonging to each task.

Table 1: Summary of SOW Task List

Task	Title	Items
1	Inspection Plan	Trash rack access plan and drawings Schedule Powerplant shutdown request
2	Mobilization and Demobilization	Monitoring water quality and reservoir levels Access to reservoir and storage of equipment
3	Camera Calibration	Camera calibration procedures for photogrammetry
4	Trash Rack Access	Trash rack lifting/jacking to provide ROV access
5	Vertical Section Inspection	Video inspection with label, location and description of any detected surface defects or irregularities
6	Horizontal Section Inspection	Same as Task 5
7	Photogrammetric Data Collection (critical areas)	Photogrammetric data process by overlapping images sufficiently and keeping the camera perpendicular to the surface Sufficient lighting to eliminate shadows

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Task	Title	Items
8	Sonar or Laser Scanning (critical areas)	1/16 inch accuracy
9	Photogrammetric Data Collection (vertical and horizontal sections)	Same as Task 7
10	Report and Deliverables	Assumptions and procedures File formats

Task 1 Description: The inspection plan facilitates collaboration during the scheduling of the inspection and to verify that the site conditions would be sufficient for the work. The trash rack plan required a professional engineer approval to limit liability. The powerplant shutdown request was required a minimum of 10 days prior to the inspection and needed to include the total time requested for the shutdown.

Task 2 Description: Historic data collected by Reclamation was used to establish the average and maximum turbidity levels as a definition of water quality. The Secchi disk was also referenced to establish maximum visibility. Historic water elevation change rates were also provided to help estimate when the trash racks would be sufficiently exposed to allow entry.

Task 3 Description: Camera calibration was required by some of the photogrammetry software (Eos Systems PhotoModeler Motion) used at Reclamation but the software (Agisoft PhotoScan Professional) used for this project can perform a field calibration that is sufficient for most projects. The calibration procedure required images captured underwater of a specially prepared calibration panel.

Task 4 Description: Drawings were provided for dimensions and weights of the trash racks. The reservoir elevation forecasts were also provided. The maximum allowable opening is given along with instructions to keep the opening secured against unauthorized entry.

Task 5 and 6 Description: The video inspection was required to be collected of every part of the intake structure – both interior and exterior. Voice-over comments were requested to accompany the video to help identify any potential defect and provide its location. Potential defects were to include spalling, cracking, abrasion/erosion, and pitting.

Task 7 and 9 Description: Standard photogrammetric data collection was specified. The maximum distance from the structure was set at 6 feet and the velocity of the ROV was limited to prevent motion blur in the images. Task 7 and 8 refer to critical areas which are defined in Table 2.

Task 8 Description: The laser or sonar data was to be performed to allow measurements and comparison to the photogrammetric data.

Task 10 Description: A draft report was required to be submitted first and reviewed by Reclamation. The comments were to be incorporated into the final draft submission. Due dates for the deliverables including the video, photogrammetric data, laser/sonar scans and the report were also outlined.

Table 2: Definition of Critical Areas

Critical Area	Description	Location (approximate)
1	Bulkhead Seal	Elevation: 2095 feet in the intake structure
2	Elbow	From about 1982 feet elevation and Sta. 14+20 to about 1960 feet elevation and Sta. 14+40
3	Upstream face of Fixed Wheel Gate	Station: 29+13
4	No more than 4 surface defects greater than 1 square foot but less than 2,000 square foot	Unknown

Scheduling

This work was closely tied to specific site conditions. In fact, the reservoir water elevation was critical to allow entry of the ROV into the intake structure. Access may have been able to be provided by using divers to assist with the trash rack lifting but would have added to the cost significantly.

Prior to 2010, the intake structure had only been exposed three times due to low reservoir elevations: once in 1978, and again in 1992 and 1993 (see Figure 3). However, due to the drought conditions in California over the past several years, the elevation dropped enough to expose the intake structure in 2014 and 2015. In 2014, the structure was exposed from August 19 to December 21, then was submerged when northern California experienced some major rainfall and flooding. Then in 2015, the structure was exposed again from August 16 to February 15 (see Figure 4). The elevation of the top of this intake structure is shown in red at 2,225 feet in both figures.

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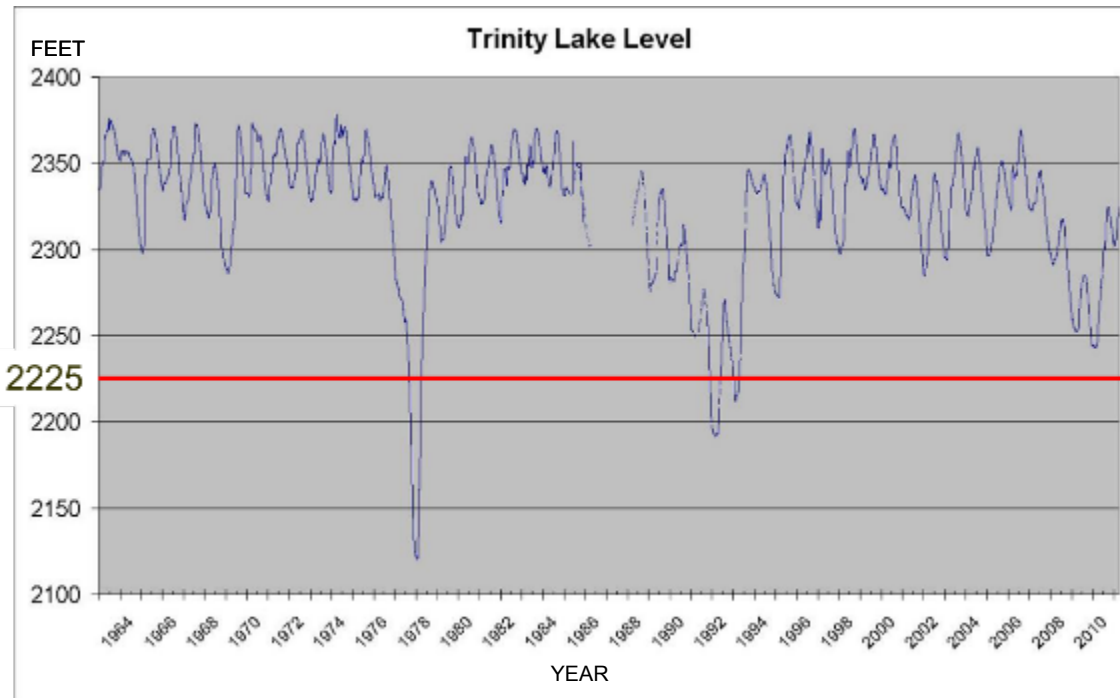


Figure 3: Trinity Reservoir Historical Elevations to 2011

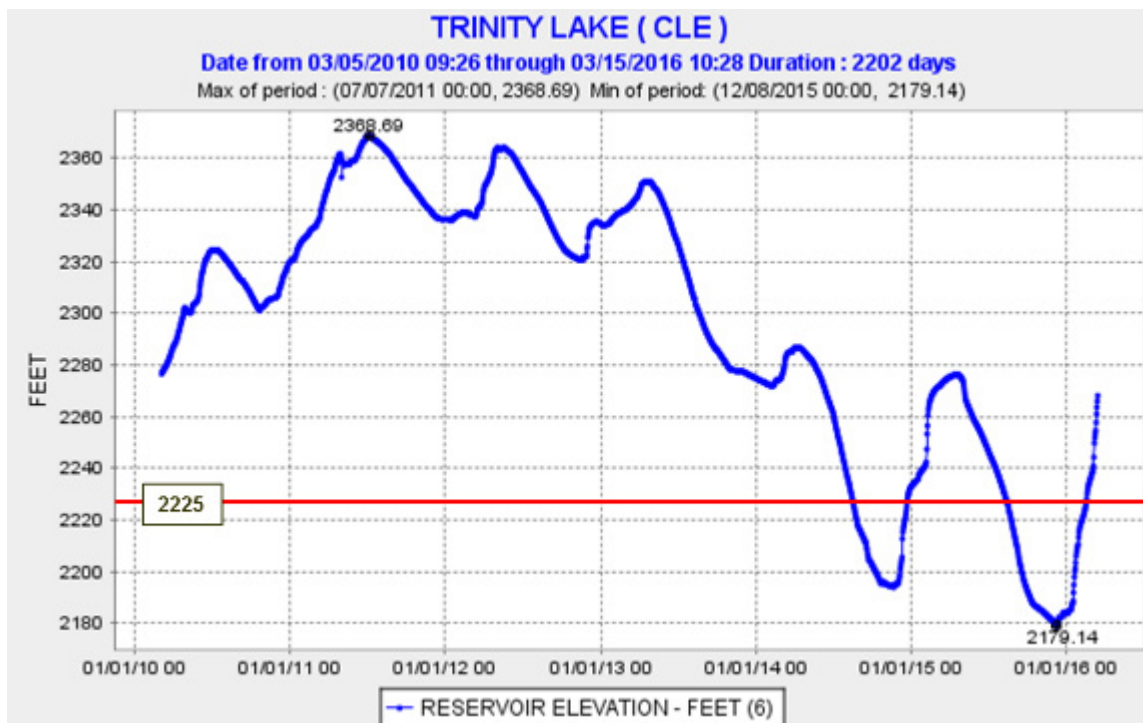


Figure 4: Trinity Reservoir Historical Elevations from 2010 to 2016 [2]

In addition to the reservoir levels, the water quality was also important. If the water was too murky, details would be difficult to see in the video and the photogrammetry model would contain points related to the suspended solids and would require post processing to filter out the noise. The historical data provided limited the turbidity to 6.0 NTU, however, the water quality data taken a couple of weeks before the inspection put the maximum turbidity over 7.0 NTU (see Figure 5).

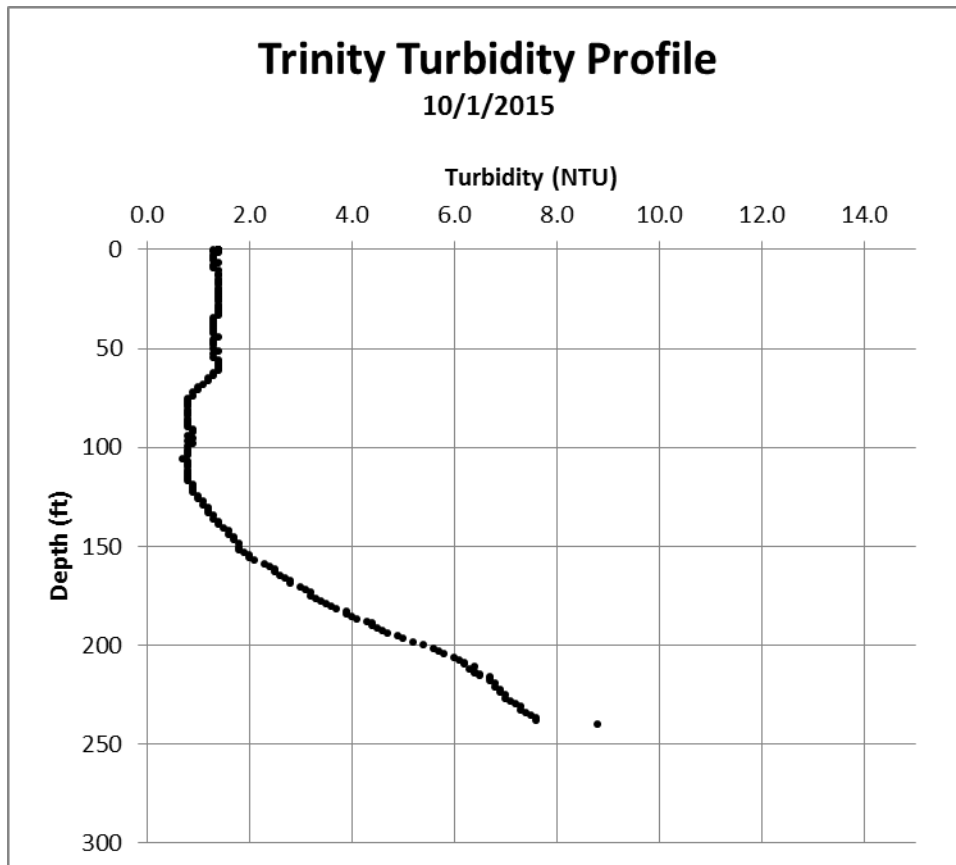


Figure 5: Trinity Turbidity Profile

Data Collection

Three types of data were expected to be collected on the Trinity Dam Intake Structure: HD video inspection, photogrammetric images (from video) and laser or sonar 3D scans. Photogrammetric images and laser/sonar 3D scans are measurement types of data. HD video was to be collected to determine if video inspections could be performed in lieu of in-person inspections. Once the intake structure is dewatered, an in-person inspection will also be performed. The results from both inspections will be compared. The camera is expected to record in 1080p resolution. 1080 refers to the number of rows or horizontal lines that the video is resolved to and is a standard format that was established based on television or computer monitor resolution. Resolutions

greater than 1080 such as 4k and even 8k¹ are beginning to become more prominent but 1080 is the most common resolution available at Reclamation. The “p” designation at the end of “1080” stands for progressive scan. The alternative is “i” or interlaced as in “1080i”. This refers to the actual refreshing of the lines in the video playback. Interlaced video refreshes every other line at the recorded frame rate of the video standard. For example, if the video standard is 24 frames per second, each line will only refresh at 12 frames per second whereas progressive scan recordings update each line in a 24 frame per second video at 24 frames per second. This is important because 1080p produces a sharper image than 1080i. Figure 6 shows a comparison between a 1080i video frame and a 1080p video frame.



Figure 6: Comparison of a 1080i video frame (left) and a 1080p video frame (right)

The inspection was expected to include all underwater portions of the intake structure. The components of the intake structure included the trash rack structure including the trash racks – interior and exterior, the vertical section of the intake structure – interior and exterior, and the horizontal section of the intake structure – interior only since the exterior is located inside the dam.

Once a potential defect was observed in during the HD video inspection, the ROV operator or other personnel was to provide the label or title, description and the location of the defect. This

¹ 4k and 8k refer to the number of columns or vertical lines in a video. 1080 video typically has 1920 vertical lines.

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information was to be stored in the video's accompanying audio track. Potential defects were defined as but not limited to spalling, cracking, excessive wear and pitting.

Photogrammetric data collection was to be performed in the entire interior of the intake. The photogrammetric data collection procedure was intended to allow the contractor freedom to determine whether they would collect the photogrammetry data simultaneously during the HD video inspection or as a separate event. If the HD video inspection was to be used for photogrammetry, specific data collection techniques would need to be followed:

- The video would need to be captured to allow for 60 percent overlap by adjacent video images to allow a point on the single frame or image to be detected on at least two other frames or images.
- The video camera should be oriented perpendicular to the surface so that the distance to similar points would remain constant and reduce error.
- The surface should be lit sufficiently to eliminate shadowing. Shadows cannot be resolved photogrammetrically.
- The ROV should be operated smoothly to prevent motion blur.
- The camera should feature a fixed focal length to reduce error in the photogrammetric calculations.
- Post-processing features of the camera such as image or color enhancement should be turned off so that the raw video contains the actual data resulting in less error.
- The maximum distance from the surface to the camera should be no greater than 6 feet to allow the resolution required to identify cracking.
- A grid pattern would be employed to collect data to ensure complete coverage and consecutive data collection.

Laser or sonar 3D scanning was performed to verify the photogrammetric 3D model and provide redundancy if the photogrammetry was not successful. The scanning was expected to be accurate to 1/16 inch. The 3D scanning was only to be performed in predetermined critical areas and depending on the range of the scanner, several scans of one area may be required. Several features of the intake structure were of special interest because of previous experience investigating deterioration associated with these features. These features were referred to as critical areas. Critical areas were those identified as needing special attention and measurements. They include the bulkhead seal, the elbow transition between the horizontal and vertical sections, and the upstream face of the fixed wheel gate. The locations of these areas are summarized in Table 2. Table 2 also shows unknown surface defects that may also need detailed measurements that may be discovered in the inspection. These defects were limited to a total of four and were to be only between 1 and 2,000 square feet in area.

Data Processing

The HD video inspection may or may not require post-processing depending on how the contractor integrated the inspection notes with the video. Photogrammetry was to be performed by Reclamation. The process was to consist of extracting frames from the video inspection that would be used to construct a 3D model. Then the frames would be processed using photogrammetry software to generate a point cloud and mesh. The data processing for the 3D scanning would include registering individual scans of the area of interest and was to be conducted by the contractor.

Analysis

The inspection video was to be equivalent to an actual in-person inspection. A comparison between the results of the video inspection and the in-person inspection will help to determine the acceptability of ROV controlled video inspections.

The photogrammetric data will be compared to the 3D scanning for accuracy. The data will also be used to determine dimensional data for any defects that may be found so that repair quantities can be estimated.

Results

The ROV inspection and data collection occurred over a 10-day period beginning October 17 to October 27, 2015. The weather throughout this time was moderate to slightly cold, temperatures between 35 and 80 degrees Fahrenheit and cloudy to partly cloudy conditions. There was little to no precipitation however there was some wind that increased waves and clouded up the water slightly. The water elevation at the beginning of the project was at 2,187.01 feet and dropped 1.17 feet over the 10 days that the contractor was onsite. Secchi disk readings showed the visibility at about 15 feet.

The data was collected from a total of five dives beginning on October 20, 2015. The dives varied in duration depending on the workday and complications with the equipment. Table 3 is from the contractor's inspection report and summarizes the dives, date, data collected, depths reached, features inspected and the total duration of the dive for the day [3]. The entire report is shown in Appendix A.

Dive 1 was performed at the end of the day, October 20, 2015. The purpose of the dive was to perform an initial inspection of the bulkhead seal and also to verify that all the ROV systems were working.

Dive 2 was performed on the afternoon of October 22, 2015. On October 21, communications could not be established between the control center and the ROV. The contractor spent all day and the next morning troubleshooting the systems. This dive tested the operation of the ROV all the way to the fixed wheel gate. The fixed wheel gate was in the open position so Reclamation

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personnel were notified to close the gate. However, the gate seals were inspected at this time. During the trip to the fixed wheel gate, the ROV navigated along the invert of the tunnel. Significant amounts of sediment were observed and it was determined that the complete inspection of the horizontal portion of the tunnel would not be possible. This also meant that photogrammetry of the horizontal section was not possible. The left spring line of the horizontal portion was inspected as well as the elbow on the return trip.

Dive 3 was performed on the afternoon of October 23, 2015. The morning was spent troubleshooting the video recording. During verification of the previous day's data, it was discovered that the video format was 1080i. Once the issue was resolved, the inspection and data collection resumed. The fixed wheel gate was also lowered and the ROV was operated down the crown of the horizontal section to inspect the fixed wheel gate. Laser scanning was also performed of the fixed wheel gate. The ROV was left in the tunnel overnight.

Dive 4 was performed on October 24, 2015. The right spring line of the horizontal section was inspected along with the vertical section of the intake structure. The ROV was operated to rotate 360 degrees at increasing elevations to provide the proper overlap for the photogrammetry. Once the ROV reached the bulkhead seal, it was operated to scrape the sediment off of the seal to expose the seal for inspection. Laser scans were also performed at the transition between the vertical section and the elbow.

Dive 5 was performed on October 25, 2015. The inspection consisted of the elbow, trash racks, and exterior of the vertical portion of the intake structure. Laser scanning was conducted on the bulkhead seal plate.

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Table 3: Data Collection Summary [3]

Date	Dive #	Data Collected	Depths	Features Examined	Duration
Oct. 20, 2015	1	HD Video Laser	0 to 200 ft.	Bulkhead Seal Plate	1 hr. 35 mins.
Oct. 22, 2015	2	HD Video	0 to 200 ft.	Fixed Wheel Gate Elbow	3 hr. 34 mins.
Oct. 23, 2015	3	HD Video Laser	0 to 241 ft.	Fixed Wheel Gate Horizontal Section	5 hr. 10 mins.
Oct. 24, 2015	4	HD Video Laser	81 to 231 ft.	Vertical Section Horizontal Section	10 hr. 15 mins.
Oct. 25, 2015	5	HD Video Laser	0 to 226 ft.	Trash Racks Bulkhead Seal Plate Intake Structure	10 hr. 26 mins.

Mobilization

The contractor arrived onsite October 17, 2015. The control center was inside of an enclosed trailer and also housed the connections to the ROV. The trailer was positioned on the crest of the dam next to the gate shaft. A generator was used to supply the required current to the ROV and support systems.

Transportation was provided to and from the intake structure using a 27-foot commercial walkaround boat. The initial boat launch was made at Minersville Public Boat Ramp and the daily access and boat storage was at Trinity Alps Marina. A barge was tied up at the intake as a work platform and to store the tether for the ROV.

The ROV was stored at the intake for the duration of the inspection. The tether for the ROV was stored on a barge tied up at the intake. The tether ran underwater from the barge to the dam and then up the face of the dam to the control center trailer.

The control center consisted of the interface to the ROV, ROV controls, ROV telemetry equipment, and data acquisition computers. A live feed from the camera, the sonar and the laser scanning was provided through a series of monitors. The video recording equipment was also located here since the video was not recorded on the ROV.

Trash Rack Jacking

Trash rack plans and drawings were submitted to Reclamation on September 14, 2015. The plans and drawings were approved by Reclamation. The jacking mechanism consisted of an upper and lower support and hydraulic jack. The trash rack drawings and plans are shown in Appendix B.

On October 18, the supports were installed on either side of the bottom of trash rack number 4 and at the top of trash rack number 3 (see Figure 7). Once the supports were secured, the hydraulic jack was connected. The trash racks were opened on October 20. Trash rack number 1 through 3 were lifted simultaneously without problems to the maximum allowable opening and a temporary block post was added in between the trash rack numbers 3 and 4 to prevent the trash racks from accidental closure. Figure 8 shows the elevations of each trash rack, the bottom of the hemispherical bulkhead and the water elevation throughout the project duration. The opening was closed with a cover to prevent unauthorized access at the end of each day. The trash racks were lowered and the equipment removed on October 26. The coating was not affected by the operations and did not require repairs.



Figure 7: Trash Rack Jacking

Photogrammetric Processing from Remotely Operated Vehicle (ROV) Data: Trinity Dam Intake Tunnel

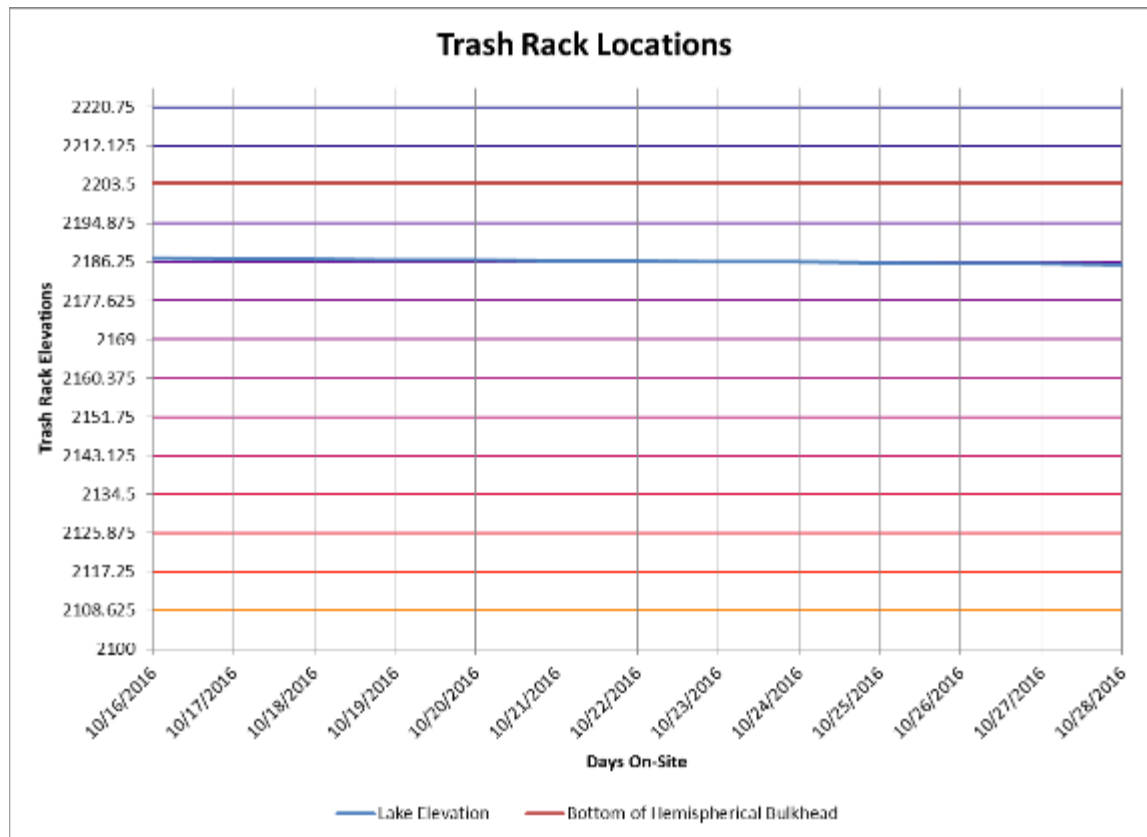


Figure 8: Trash Rack Locations

ROV specs

The contractor used the Sub-Atlantic Mojave ROV platform. Its features include four horizontal thrusters, one vertical thruster and a 1,000 foot depth rating. It is about 40 inches long, 24 inches wide and 20 inches tall. It was fitted with an HD 1080p video camera, a low-light monochrome camera, a sector scan sonar system, a laser scanning system and LED lighting. The ROV also featured an electronic depth gauge and compass. The ROV is shown in Figure 9 and was being fitted with sensors prior to dive testing.



Figure 9: Mojave ROV

The distance from the top of the intake structure to the upstream face of the fixed wheel gate was approximately 2,200 feet and the control center was located on the crest of the dam near the gate chamber nearly doubling the required tether length. A special long-range neutrally buoyant tether was used. The tether carried the ROV control input, telemetry, video, sonar and laser data and an encoder was used to capture the distance from the tether payout to the ROV.

HD Video Inspection

The intake structure was inspected over a total of five days. All features were inspected. The general condition of the structure was excellent. The inspection did not reveal any major abrasion/erosion, settling cracks, misalignments, spalling or corrosion related issues. Most of the defects observed indicated defects that were defects related to construction practices such as bug holes, honeycombing, rock pockets and unfilled tie rod bolt holes. The largest defect noted was some concrete loss at a joint between the vertical section and elbow transition. It appears the joint was feathered edged and unreinforced.

No issues were observed with the trash racks. There was minimal corrosion detected and little to no coating loss. Most horizontal surfaces were coated with a layer of sediment. Some foreign objects were noted caught in the trash racks such as buoys and wood.

Photogrammetric Processing from Remotely Operated Vehicle (ROV) Data: Trinity Dam Intake Tunnel

The bulkhead seal was coated with several inches of sediment. The ROV operator used the ROV sled and thrusters to clean off a large portion of the sediment. A small diameter (~3/16 inch) wire was found draped over the bulkhead seal.

The fixed wheel gate, seals and guide did not appear to have any major issues. A small amount of corrosion was detected but did not appear to affect the operation of the gate.

A summary of the condition of each feature is shown in Table 4. Details of the inspection can be found in the inspection report found in Appendix A. The video of the entire inspection is also available. Reclamation also reviewed the video and the table of features and potential defects along with pictures is shown in Appendix C.

Table 4: General Condition Summary

Feature	Dive	General Condition
Trash Racks	5	¼ inch to 1 inch sediment on horizontal members Minimal corrosion Little to no coating loss Minor foreign objects: wood and buoy
Bulkhead Seal	1 and 5	¼ inch to 2 inches sediment initially Scattered sediment after debris removal operations No corrosion or section loss noted ~3/16 inch wire rope draped over seal
Vertical Section of the Intake Structure (Interior)	4	Coated with light biological or sediment film Unfilled tie rod bolt holes Minimal construction defects: bug holes, honeycombing, poor consolidation Slight wear or loss at feather edge joint between vertical section and elbow transition
Vertical Section of the Intake Structure (Exterior)	5	Thick sediment on horizontal members No noted cracks or spalls Minor corrosion of steel elements: conduits, angles, pipes
Elbow Transition	2	Coated with light biological or sediment film No noted cracks or spalls

Feature	Dive	General Condition
		Slight wear or loss at feather edge joint between vertical section and elbow transition
Horizontal Section of the Intake Structure	2, 3 and 4	Coated with light biological or sediment film Minimal construction defects: bug holes, honeycombing, poor consolidation Minimal cracking near joints Possible spray-painted stationing visible along crown at regular intervals
Fixed Wheel Gate Seal and Guides	2	Minimal corrosion Minimal construction defects on surrounding concrete: bug holes, honeycombing, poor consolidation No notable damage, misalignments or wear
Upstream Face of the Fixed Wheel Gate	3	Minimal corrosion No notable section loss

3D Laser Scans

The results of the fixed wheel gate laser scan are shown in Figure 10. The figure represents a height map of the upstream face of the gate. The model was composed of ten separate scans and then registered in post-processing software by the contractor. To capture the data, the ROV would be held stationary against another surface by using the thrusters. The red areas are places where the laser data could not be collected due to suspended sediment in the water and because of the extents the laser scanner range.

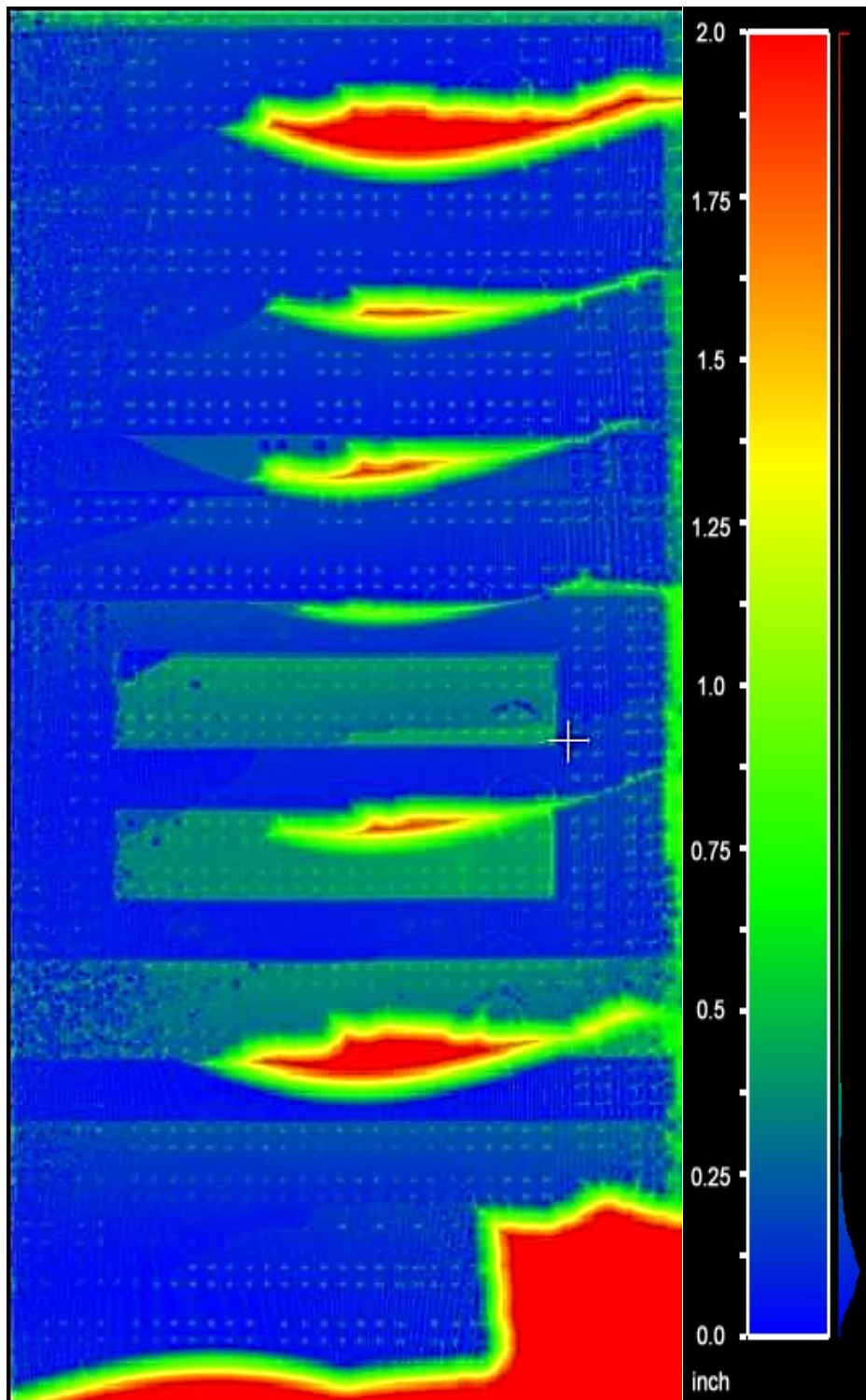


Figure 10: Height Map of the Upstream Face of the Fixed Wheel Gate

Figure 11 shows the height map of the bulkhead seal 3D scan. The seal location is uniform and free of any defects or anomalies. The model was composed of 16 total scans.

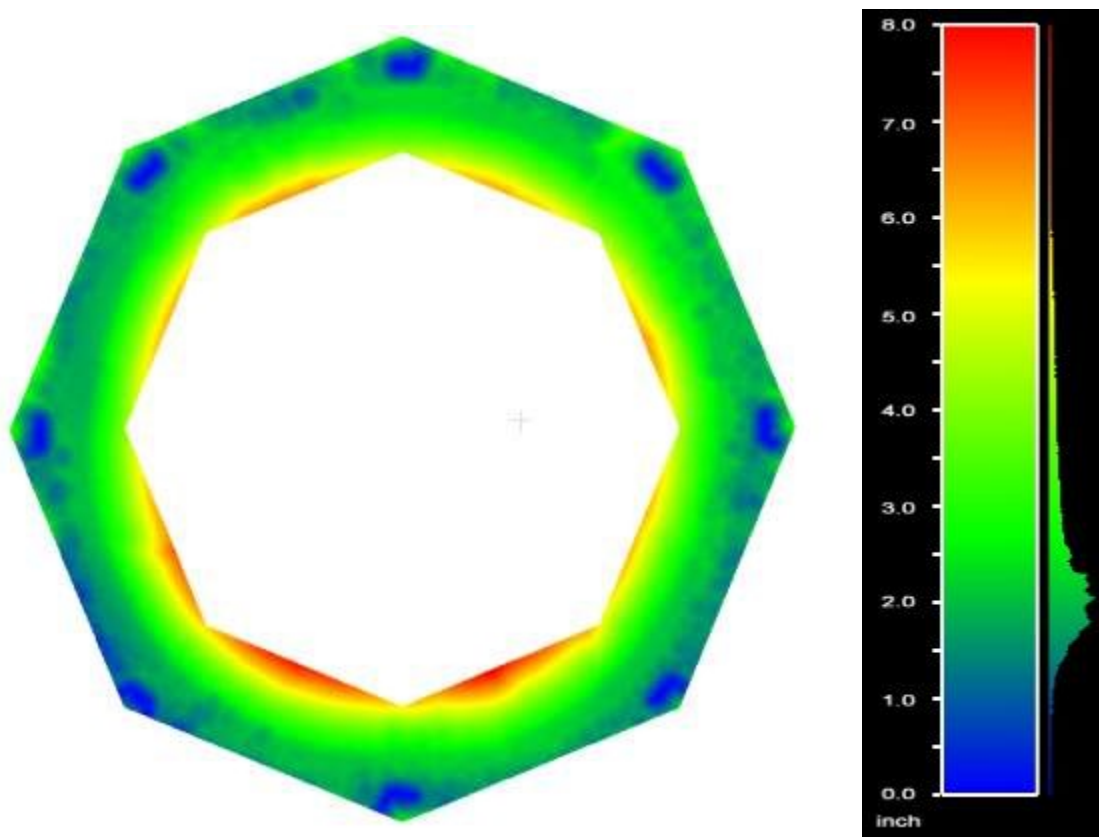


Figure 11: Height Map of the Bulkhead Seal

Photogrammetry

The photogrammetric data was processed by Reclamation. The first step in the process was to extract individual images from the video. After the images are extracted, they were inspected and images with blur or that are out of focus were removed from the data set. Then the data was loaded into the photogrammetry software using the calibration parameters previously collected to solve for the locations of the camera during data collection.

Image extraction was done using computer programs. However, some programs resize the picture during the extraction while photogrammetry can only be conducted on native resolutions. Sony Movie Studio Platinum and Eos Systems PhotoModeler Motion can extract all images or images at regular intervals (such as every tenth frame) automatically from a video. EOS Systems PhotoModeler can also analyze a video and choose which frames would be best suited for matching in photogrammetry. However, if features can't be tracked in the video due to motion blur, the image extraction will fail. VLC Media Player can also extract images but must be done manually.

Once the images were extracted, they were inspected for quality photogrammetric images. Only images that were free of motion blur and that were in focus could be used. For the fixed wheel gate photogrammetry, about 40 minutes of video was collected resulting in about 70,000 images

(29 frames per second). Each of these images were inspected and the remaining quality images numbered nearly 2,000. On a project like this, only about 40 images are required to generate the model. Since the images were only 2 MP apiece and because of the poor water quality, all images were used.

Before being able to solve a photogrammetry model, the camera has to be calibrated in order to solve for the positional elements of the particular model. Ideally, each camera and lens should be calibrated for each model using a special calibration panel. However, most photogrammetry software can perform a so-called field calibrations using the actual model data. Since this project included data collected underwater, a calibration was performed to insure the quality of the photogrammetry (see Figure 12). The calibration panel was placed underwater and video of the panel was collected and processed to generate a calibration file.

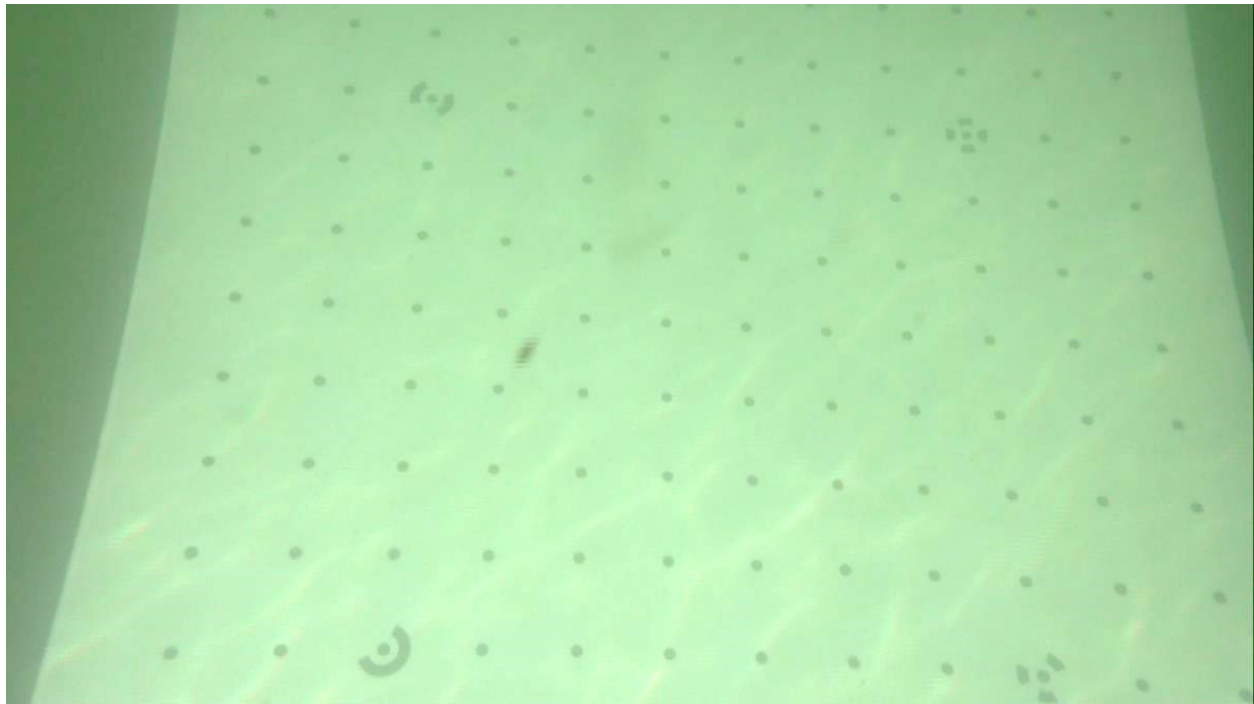


Figure 12: Calibration Panel

After ordering the quality images, they were then processed using Agisoft PhotoScan Professional. This is performed in two steps: key point selection is performed using the scale-invariant feature transform (SIFT) algorithm along with a least squares nonlinear function fit to solve for the locations of the camera positions. After the camera positions are solved, error is removed iteratively from the model to improve the model accuracy. Then the point cloud model can be generated. The point cloud consisted of nearly 50 million points (see Figure 13).

Using the point cloud, a surface can be produced over the points resulting in a mesh. The mesh is used to transform the points into an object. This object is then overlaid with a photorealistic texture from a stitched mosaic of all the images. The result is a 3D model that appears like the

Photogrammetric Processing from Remotely Operated Vehicle (ROV) Data: Trinity Dam Intake Tunnel

actual subject captured. The stitched mosaic can be exported as an orthophoto. An orthophoto is a projection of the surface without distortions based on perspective (see Figure 14).



Figure 13: Point Cloud Model of the Upstream Face of the Fixed Wheel Gate

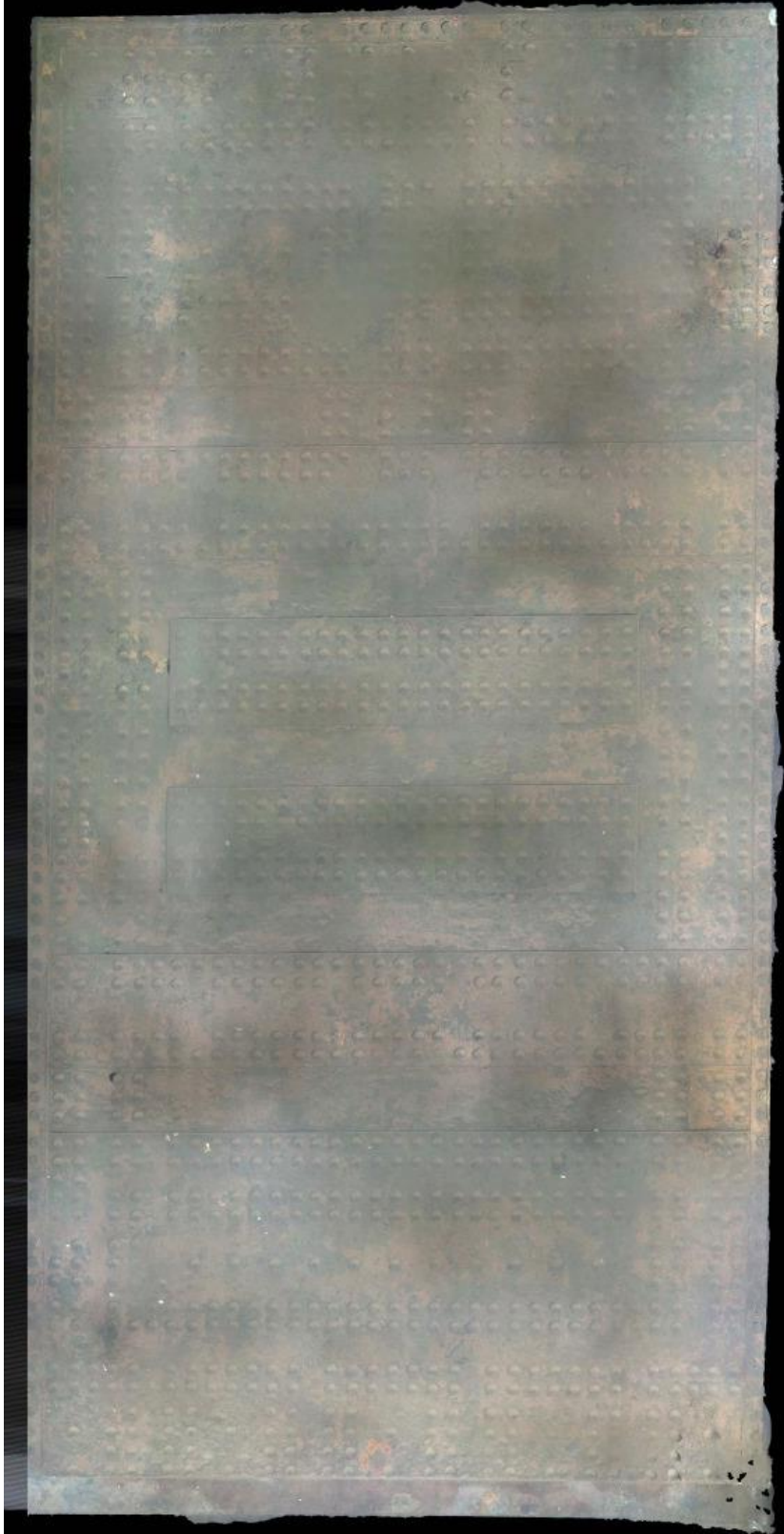


Figure 14: Orthophoto of the Upstream Face of the Fixed Wheel Gate

Conclusions

Despite several challenges related to the site conditions, the ROV inspection, data collection and photogrammetric processing of the Trinity Dam Intake Structure was successfully executed. The inspection revealed that the structure is in excellent condition and this information can be used in further decisions about the ongoing mechanical refurbishment project. The results also show how ROV's can be used at other Reclamation structures for decision making. Laser scanning was also performed and demonstrated its ability to provide 3D modeling capability. Photogrammetry was used to develop a 3D model and orthophoto of the fixed wheel gate for use by corrosion inspectors at Reclamation.

The project challenges, ROV data collection and results were presented at the 2016 Reclamation Construction and Geology Conference in Denver, Colorado, the 2016 National Association of Corrosion Engineers Concrete Service Life Extension Conference in Orlando, Florida, and during the Photogrammetry Users Group Webinar #1.

Several key considerations for using this technology are given:

- An ROV was used to inspect a 1,700 foot long and 200 foot deep underwater tunnel.
- ROV entry to Reclamation structures should be considered in future rehabilitations or designs. In some cases, the structure can be accessed during low water events.
- Water quality of less than 10 NTU and greater than 15 foot visibility are required for underwater optical inspections and photogrammetry.
- An ROV with HD video capabilities can be used to detect most defects.
- Underwater HD video can be used to create a photogrammetric 3D model.

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- [1] M. Klein, "Photogrammetric Processing from Unmanned Aerial System (UAS) Data: Elephant Butte Dam," US Bureau of Reclamation, Denver, 2016.
- [2] State of California, "Trinity Lake (CLE)," 15 03 2016. [Online]. Available: http://cdec.water.ca.gov/jspplot/jspPlotServlet.jsp?sensor_no=2412&end=03%2F15%2F2016+10%3A28&geom=huge&interval=2202&cookies=cdec01. [Accessed 2016].
- [3] Hibbard Inshore, LLC, "Report for the Intake Inspection of Trinity River for Bureau of Reclamation Bid #R15PS01265," Hibbard Inshore, LLC, Auburn Hills, 2016.

Appendices

Appendix A: Report for the Intake Inspection of Trinity River for the Bureau of Reclamation Bid #R15PS01265 by Hibbard Inshore, LLC

Appendix B: Trash Rack Jacking Plan and Drawing

Appendix C: Trinity Video Inspection Results

Appendix A:

Report for the Intake Inspection of Trinity River for the
Bureau of Reclamation Bid #R15PS01265 by Hibbard
Inshore, LLC



Report

For the
Intake Inspection
Of
Trinity River
For
Bureau of Reclamation Bid #R15PS01265

Version 7
May 9, 2016
Job 514507

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2 Executive Summary

Hibbard Inshore, LLC. provided ROV inspection services to the Bureau of Reclamation to discover and document the condition of the exterior and interior of the intake structure from the water surface to the elbow (vertical) and from the elbow to the fixed wheel gate. The inspection collected qualitative and quantitative data for the Bureau of Reclamation's use. Sensors used to collect data included HD video and laser. The HD video was recorded by flying the ROV in a path verified by the client so that the video could be used for video inspection and photogrammetry processing by the client. In three key areas, 3D measurements were taken by laser.

The inspection was meant to determine the condition of the concrete, condition of the steel and sediment. Sediment had settled on the invert of the horizontal section preventing an inspection of the concrete at that location. The bulkhead seal was also initially covered by sediment. This sediment was mostly removed with the ROV's thrusters to facilitate the inspection. The concrete was mostly free of major defects such as cracks and spalling. The steel parts of the fixed wheel gate showed minimal corrosion. The fixed wheel was initially in the open position allowing for an inspection of the fixed wheel gate guides. The trash rack sections appeared to be in good condition with their coal tar coating still intact. There were a few instances of wooden and steel debris in the lower trash rack sections and a few instances of rust nodules. No displaced, missing or bent bars were located.

The HD video was also intended to be used to supply data to the client in order to produce a 3D model of the entire interior of the intake structure. However, the water quality was below the threshold required to collect the data. Photogrammetric HD video collection in the vertical section of the intake structure was attempted. Photogrammetric data was also collected at the bulkhead seal, portions of the elbow and the upstream face of the fixed wheel gate.

3D laser data was also collected for the upstream face of the bulkhead seal, portions of the elbow and the bulkhead seal.

This report is a summary of the data collected and the conduct of the operations for the inspection. This report is intended to be referenced in addition to the inspection data provided on an accompanying external hard drive.

3 Conventions

3.1 Video Capture Date and Time

This report will refer to inspection data, pictures and the video record based on time. The format of the time is minutes and seconds represented as 21:44 for 21 minutes and forty four seconds from the start point of the file. The file name will start with the file name for the video file, and then have the minutes and seconds from the start of the file. This allows the video to be cross referenced with the pilot notes. The overlay typically used for inspection was removed to aid in using the video for photogrammetry.

The following is an example of a screenshot file extension reference for the report: 205140_190_1_29_19 Seal Plate.png. The first set of number references the video file and in this case is 205140.mp4. The second set of numbers describes the time position referenced from the beginning of the video file and for this example is 190 seconds from the start of the file. The next three digits describe the time the picture can be viewed when the SubC viewing software is used. In this example the time is 1 hour, 29 minutes and 19 seconds. The final letters are used to describe the image.

3.2 Right and Left

The written comments on the inspection will indicate the location of the ROV or a feature using the "right" or "left" convention. The orientation for "right" or "left" is based on the observer facing downstream.

3.3 ROV Depth

The depth displayed by the ROV is measured from a pressure sensor on the ROV. Zero depth is the surface of the water. The sensor is calibrated for fresh water and is set to zero at the job site to account for altitude. The sensor is a ScanSense PS 30 depth sensor. This sensor has a range of 0 - 30 BAR and an accuracy of +/- 0.1% full scale. This results in an accuracy of the sensor is +/- 0.3m.

Note that a particular depth will not always correlate to the same elevation due to changing reservoir levels during the project.

3.4 Playback Software

3.4.1 SubCDivePlayer

SubCDivePlayer is the name of a system of software used to record and playback inspection data. SubCDivePlayer was used to record the video and inspection notes during the inspection. EdgeViewer is a freely distributed playback software that will be included with the inspection report.

4 Inspection

The inspection was designed to evaluate and document the condition of the exterior and interior of the intake structure. The water clarity was poor and limited the visibility enough to prevent practical photogrammetry along the length of the intake tunnel. Reclamation measured the water quality near the intake structure on October 22. They used a Secchi disk in both the shadow and sunlight and measured 11 and 15 feet visibility respectively. The inspection was performed over the course of five dives with one dive each day beginning October 20.

4.1 Naming Convention

The vertical columns of the intake structure were labeled with two different schemes. The first scheme was implemented for the video collection beginning on Dive one. Column 1 is located to the right of the open trash rack and the numbering continues counter-clockwise. The trash rack opened was to the right of flow centerline when looking downstream.

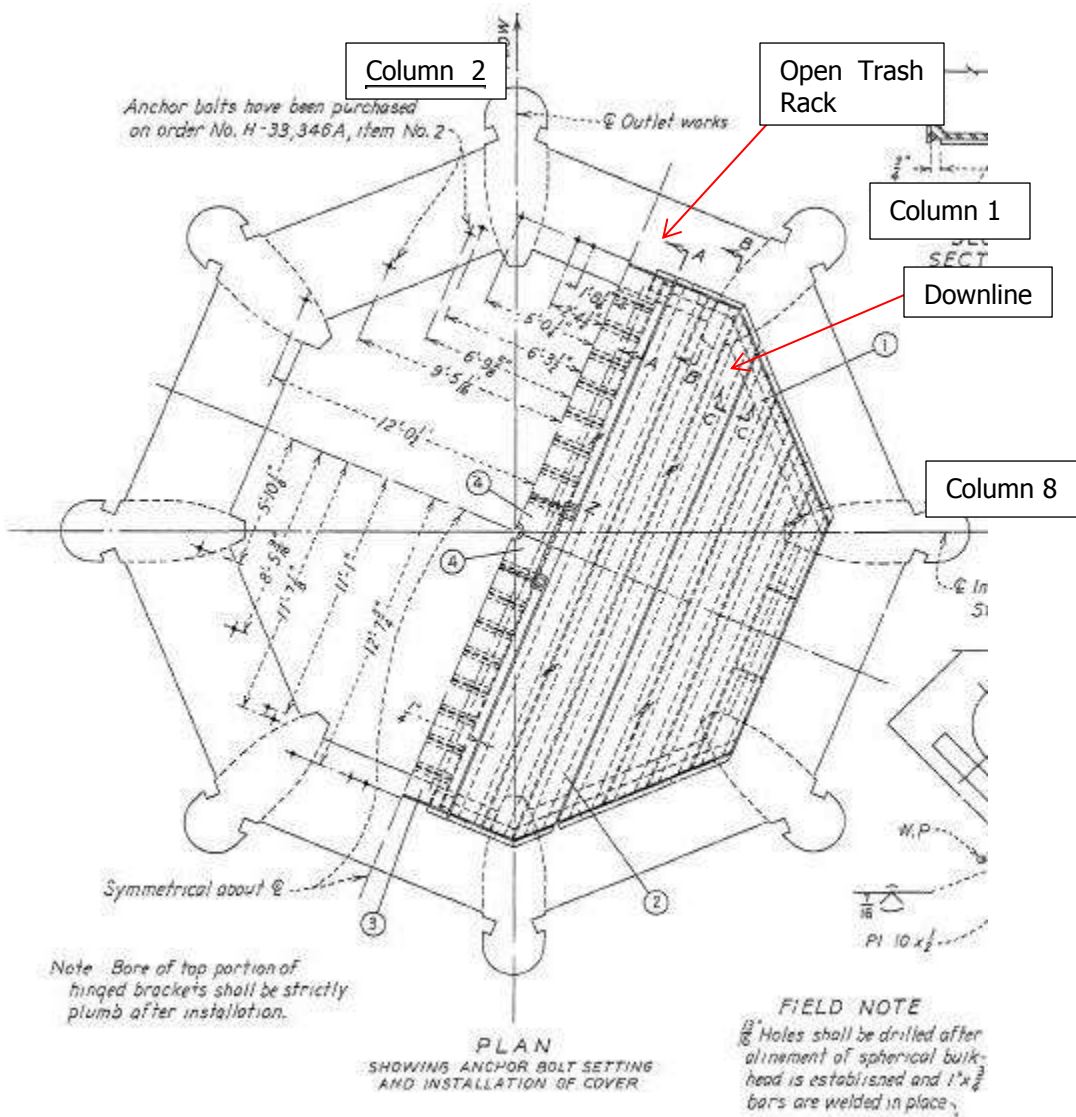


Figure 1 - Open trash rack location and HD video column labeling system

The second naming scheme was implemented for the laser scans. The columns and spaces between the columns were lettered. The open trash rack between columns 1 and 8 was labeled "d" and continued counter-clockwise. The next column 2 was labeled as "e", then trash rack "f", then column 3 as "g" and so on.

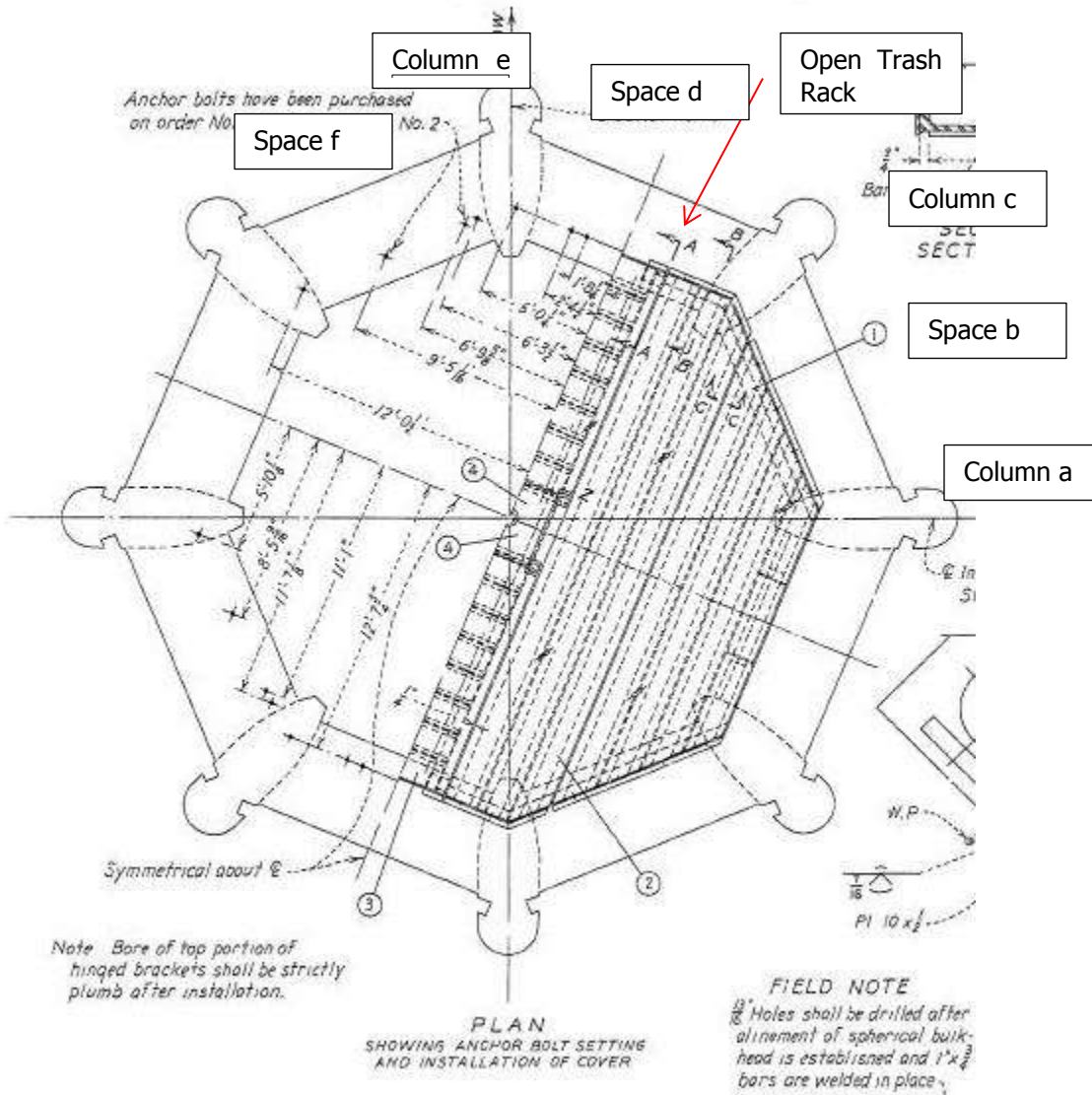


Figure 2 - Column labeling for laser scans

4.2 Trash Rack Lifting to Insert ROV

The intake structure did not have an access door for inspection, so a hydraulic jack system was designed and installed to lift several rack sections to gain access. The jacking system design was stamped by McMillen Jacobs Associates.

4.3 ROV Control

The control of the ROV was from the top of the dam in a control room. Tether was placed down the face of the dam and in the water to the intake structure. A total of 4,000 feet of tether was used for this project. Approximately 2000 feet of tether was used from the control room to the top of the intake structure. 1700 feet of tether was used from the entry through the trash rack to the Fixed Wheel Gate.

The control room featured the computers for data collection and the control electronics for the ROV. The control electronics included the high voltage transformer, high voltage control panel, telemetry control panel, video monitors and joystick. Separate computers were used to record video, record sonar and record laser. The video and sonar data was viewed live on monitors while recording the data to computer. Inspection notes were entered into the video recording computer, SubCDVR.

4.4 Inspection Plan

There were five dives performed ranging from 1:35 to 10:26 in a day. The portion of the structure inspected and data types collected are summarized in Table 1 - Dive Descriptions"

Table 1 - Dive Descriptions

Date	Dive #	Data Collected	Depths	Features Examined	Duration
Oct 20 2016	1	HD Video Laser	0 to 200 ft.	Bulkhead Seal Plate	1 hr. 35 min
Oct 22 2016	2	HD Video	0 to 200 ft.	Fixed Wheel Gate Elbow	3 hr. 34 min
Oct 23 2016	3	HD Video Laser	0 to 241 ft.	Fixed Wheel Gate Horizontal Section	5 hr. 10 min
Oct 24 2016	4	HD Video Laser	81 to 231 ft.	Vertical Section Horizontal Section	10hr 15 min
Oct 25 2016	5	HD Video Laser	0 to 226 ft.	Trash Racks Bulkhead Seal Plate Intake Structure	10 hr. 26 min



Figure 3 - Trash rack jacks installed and racks open with ROV on floating platform

4.5 Data Collection

Type of Data	Location on Structure	File Location	Format
HD Video	Vertical Section	<Drive>:\Trinity Video\Dive Four\HD\Videos	.mp4
BW Video	Vertical Section	<Drive>:\Trinity Video\Dive Four\BW	.mpg
Sonar Video	Vertical Section	<Drive>:\Trinity Video\Dive Four\Sonar	.mpg4
Photogrammetric Video	Vertical Section	<Drive>:\Trinity Video\Dive Four\HD\Videos	.mp4
Raw Laser	Spherical Valve	<Drive>:\Trinity Laser\day 5	.xyz
HD Video	Elbow	<Drive>:\Trinity Video\Dive Two\HD\Videos	.mp4
BW Video	Elbow	<Drive>:\Trinity Video\Dive Two\BW	.mpg
Sonar Video	Elbow	<Drive>:\Trinity Video\Dive Two\sonar	.mp4
Photogrammetric Video	Elbow	<Drive>:\Trinity Video\Dive Two\HD\Videos	.mp4
Raw Laser	Elbow	<Drive>:\Trinity Laser\day 4	.xyz
HD Video	Horizontal Section	<Drive>:\Trinity Video\Dive Three\HD\Videos <Drive>:\Trinity Video\Dive Four\HD\Videos	.mp4
BW Video	Horizontal Section	<Drive>:\Trinity Video\Dive Three\BW <Drive>:\Trinity Video\Dive Four\BW	.mpg
Sonar Video	Horizontal Section	<Drive>:\Trinity Video\Dive Three\Sonar <Drive>:\Trinity Video\Dive Four\Sonar	.mp4
HD Video	Fixed Wheel Gate	<Drive>:\Trinity Video\Dive Two\HD\Videos <Drive>:\Trinity Video\Dive Three\HD\Videos	.mp4

Type of Data	Location on Structure	File Location	Format
BW Video	Fixed Wheel Gate	<Drive>:\Trinity Video\Dive Two\BW <Drive>:\Trinity Video\Dive Three\BW	.mpg
Sonar Video	Fixed Wheel Gate	<Drive>:\Trinity Video\Dive Two\sonar <Drive>:\Trinity Video\Dive Three\Sonar	.mp4
Photogrammetric Video	Fixed Wheel Gate	<Drive>:\Trinity Video\Dive Two\HD\Videos <Drive>:\Trinity Video\Dive Three\HD\Videos	.mp4
Raw Laser	Fixed Wheel Gate	<Drive>:\Trinity Laser\day 3	.xyz
HD Video	Intake Structure	<Drive>:\Trinity Video\Dive Five\HD\Videos	.mp4
BW Video	Intake Structure	<Drive>:\Trinity Video\Dive Five\BW	.mpg
Sonar Video	Intake Structure	<Drive>\Trinity Video\Dive Five\Sonar	.mp4
HD Video	Bulkhead Seal Plate	<Drive>:\Trinity Video\Dive One\HD\Videos <Drive>:\Trinity Video\Dive Five\HD\Videos	.mp4
BW Video	Bulkhead Seal Plate	<Drive>:\Trinity Video\Dive One\BW <Drive>:\Trinity Video\Dive Five\BW	.mpg
Sonar Video	Bulkhead Seal Plate	<Drive>\Trinity Video\Dive Five\Sonar	.mp4
Photogrammetric Video	Bulkhead Seal Plate	<Drive>:\Trinity Video\Dive One\HD\Videos <Drive>:\Trinity Video\Dive Five\HD\Videos	.mp4
HD Video	Calibration	<Drive>:\Trinity Video\Calibration\Videos	.mp4

4.6 Dive One

Dive one, performed on October 20 2016 from 20:54 to 21:29, incorporated both a visual inspection and tests of the laser. The visual inspection was of the bulkhead seal plate area and column 3 at a depth of 82 ft. The reservoir level was 2186 ft. and a Secchi disk was used (by Customer) to measure 6 – 8 nTu turbidity.



Figure 4 - Third column and sediment on bulkhead seal at a depth of 81 ft. and heading 103.7



Figure 5 - Bulkhead seal plate partially visible under sediment at a depth of 81.5 ft. and heading 103.7

The seal plate was initially covered with sediment and wasn't visible. The steel transition from the seal plate to the concrete shaft was visible and was inspected. Laser scans were tested by holding the ROV against the side of the shaft at the steel transition with the thrusters. The lights were turned off during laser scans because they could affect the performance of the laser because the laser operates in the visible light spectrum.

The inspection started with column 1 and continued to the bottom where the bulkhead seal plate is located. The seal plate was inspected from the first column counter clockwise. During this inspection the

seal plate was covered in sediment. Then laser scans were taken to test the settings. The trash rack between columns 1 and 8 was also inspected.



Figure 6 - Fourth cross member from top on trash rack between column 1 and 8

4.7 Dive Two

Dive two was performed on October 22nd 2015 from 17:58 to 21:32. The water elevation at the start of the dive was at 2186 ft. The fixed wheel was in the open position for this dive. The ROV started at the surface and descended down the vertical shaft to the elbow. The ROV then traveled to the fixed wheel gate following the invert of the horizontal section. During this inspection the invert was covered in 1 – 2 inches of sediment obscuring the condition of the invert concrete. The gate seals and a majority of the transition to the gate were inspected including a bypass pipe.

Joints with some edge spalling were visible through the sediment as seen in Figure 7.



Figure 7 - Joint visible through sediment on invert

The fixed wheel gate was in the up position during the inspection. The position of the gate allowed an inspection of the gate slots with seal plates and roller guides. The right gate slot was inspected first with a focus on the roller plate on the downstream side of the right gate slot shown in Figure 8. The bottom right wheel had some tuberculation and the rest of the metal surfaces showed a light amount of corrosion. The roller plate had all of its bolts and was free of cracks, heavy corrosion or apparent misalignment. This was the same condition of the left roller plate.



Figure 8 - Upper edge of right roller plate on Fixed Wheel Gate

The seal plates had all of their bolts and displayed light corrosion or fouling and free of apparent misalignments. There were signs of wear consistent with mating seal plates.



Figure 9 - Bottom of left seal plate on Fixed Wheel Gate

The top seal plate was visible below the gate. The bottom seal of the gate was also inspected and shown to have light corrosion.



Figure 10 - Top left seal plate on Fixed Wheel Gate

After the seal plates and roller guides were inspected the air vent on the crown downstream of the gate was inspected shown as in Figure 11.



Figure 11 - Air vent downstream of gate

Some small areas of exposed aggregate were visible downstream of the right roller guide plate. Shown in Figure 12 - Exposed aggregate downstream of right roller plate is minimal and is flat without spalling or concrete surface separation.



Figure 12 - Exposed aggregate downstream of right roller plate

The concrete near the bottom seal also had some exposed aggregate as shown in Figure 13. The seal plate doesn't have any apparent mis-alignment or excessive wear.



Figure 13 - Exposed aggregate on invert downstream of the bottom right seal plate

The tether is visible on top of the bottom seal. The tether was followed along the invert when returning to the elbow. The invert was followed along with portions of the left wall. The sediment layer on the invert diminished once above the 7:30 clock position. The character of the wall mimicked the crown.

The elbow was visually inspected with 360 degree rotations at increasing elevations with a total of 5 revolutions. The condition of the concrete was consistent with the exception of the clean spots on the transition of the elbow at the location of the tether contact. This area was cleaner with the fouling removed from the concrete surface. The joint between the bottom of the shaft and the top of the elbow was the most pronounced joint with slight separation and edge spalling as seen in Figure 14.



Figure 14 - Joint at bottom of shaft and top of elbow

The joints were free of cracks and edge spalling in most locations. Some exposed aggregate was located on the second 360 in the elbow shown in Figure 15.



Figure 15 - Exposed aggregate at joint in shaft on second 360 from bottom

After the five 360 inspections in the elbow the ROV returned to surface for the end of the day and end of Dive two.

4.8 Dive Three

Dive three, performed on October 23rd from 13:26 to 18:29, began after Reclamation personnel lowered the fixed wheel gate for inspection. The water elevation at the start of the dive was at 2186 ft. A downline was placed in the shaft because the reinforcement embedded in the concrete and other steel features such as the trash rack interfere with the magnetic compass on the ROV making readings unreliable for navigation and orientation. The downline was placed next to column 1 and landed on the hemispherical bulkhead seal. The ROV was then used to further lower the line into the vertical section where the downline weight settled into the sediment in the elbow. The ROV was manipulated down the vertical section and into the horizontal section. The tether counter was reset to zero at the crown of the tunnel at the end of the elbow. The crown of the tunnel was inspected to the fixed wheel gate. The fixed wheel gate was visually inspected and then scanned by laser.



Figure 16 - Crown of tunnel at end of elbow at a depth of 214.1 ft. and heading 131.5

The crown of the tunnel was consistent in characteristics. The joints were regularly spaced and similar in appearance throughout the length of the tunnel. The joints were closed and free of cracks. A white biological coating, believed to be calcium carbonate, on the concrete was observed.



Figure 17 - Joint at crown with white biological coating at a depth of 215.8 ft. and heading 153.8

At several locations, spray painted numbers were observed possibly referring to the project stationing. If the paint was applied prior to putting the structure in service over 50 years ago, it would seem to indicate that the concrete is generally in very good condition without erosion abrasion, chemical attack or other types of deterioration.



Figure 18 - Paint on crown at a depth of 218.8 ft. and heading 156.4

The inspection along the crown ended at the taper leading to the fixed wheel gate. The fixed wheeled gate was inspected left to right along the top edge. Then the gate was inspected right to left immediately below the previous pass while maintaining an approximate 40 to 60 percent overlap with the previous pass. This was repeated until the entire fixed wheel gate was visually inspected and the data collected for photogrammetry. The corrosion on the face of the gate was minimal and distributed uniformly across the face of the gate. The gate was fully closed during the inspection and no debris was on the bottom area after the light dusting of sediment was dispersed by the ROV maneuvering. However, the dispersed debris reduced visibility especially when inspecting at the lower part of the gate. The transition between the face of the gate and the concrete walls were also captured at 45 degrees to the face of the gate.



Figure 19 - Top left of roller gate at a depth of 225.2 ft. and heading 177.2

Laser measurements of the gate were accomplished by holding the ROV stationary against the gate using the thrusters. The scans were performed at two foot elevation intervals along the center of the gate. The lights were turned off during laser scans, but were used for repositioning and navigation.

4.9 Dive Four

Dive four was performed on October 24th from 9:19 to 18:12 and included a photogrammetric data collection of the vertical shaft and the inspection of the right springline and crown of the horizontal section. The water elevation at the start of this dive was at 2186 ft. The circumferential inspection of the intake shaft began at a depth of 199 feet and advanced upward. The circumferential inspections alternated rotation directions to prevent twisting the tether. The downline lowered next to column 1 was used as a visual reference point.

The surface of the shaft was consistent throughout in terms of a light biological covering and excellent quality of the concrete. The biological covering was minimal and easily removed if the ROV brushed up against it. Figure 20 shows the feather edge transition joint between the downstream face of the vertical section and the crown of the elbow. This joint showed the largest separation of all the joints in the structure.



Figure 20 - Joint and downline in shaft at a depth of 198.7 ft. and heading 173.4

The circumferential inspections continued from 199 feet to 82 feet in two foot increments to allow the inspection video to be used for photogrammetry. Tie rod holes started appearing at about 109 feet and continued to 120 feet of depth.

Table 2 - Locations of Tie Rod Bolt Holes

Date	Time	Description	Depth	Heading
10/24/2015	13:32:03	South end of pass at 109 ft. with several tie rod bolt holes	109.4	201.4
10/24/2015	11:55:35	South end of pass at 116 ft. with several tie bolt holes open	116	147.4
10/24/2015	11:44:51	Four more tie rod bolts at 119 ft. depth and 250 degrees heading	118.5	252
10/24/2015	11:41:45	Four tie rod bolt holes at 160 degrees at 118 ft.	118.6	155.9
10/24/2015	11:45:07	One more tie rod bolt at 119 ft. depth and 250 degrees heading	118.6	265.2
10/24/2015	11:48:55	Most tie rod bolt holes open above and below joint	118.6	186.2
10/24/2015	11:33:41	Tie rod bolt hole open at 119 ft. depth and 205 degrees heading	119.6	196.1
10/24/2015	11:38:43	Tie rod bolt hole	119.8	334.4
10/24/2015	11:39:00	Tie rod bolt hole	119.9	295.7
10/24/2015	11:39:39	Tie rod bolt hole with depth less than 1 inch	120.1	234.8

**Figure 21 - Tie rod bolt hole in concrete at a depth of 120.1 ft. and heading 234.8**

The characteristics of the concrete were consistent with similar texture, little to no spalling, erosion or other defects, until 94 feet of depth. At 94 feet, some honeycombing in the concrete was discovered. The honeycombing featured exposed aggregate although it appeared that the aggregate was coated with a layer of cement paste.



Figure 22 – Honeycombed concrete featuring exposed aggregate at a depth of 94.5 ft. and heading 216.6

An 8 inch air supply vent was located at 86 feet of depth.



Figure 23 - 8 inch air supply vent at a depth of 86.5 ft. and heading 128.6

The top of the shaft has a steel ring that mates with the seal on the hemispherical bulkhead. The transition from concrete to the steel ring begins at 85 feet of depth.



Figure 24 - Transition from concrete to steel ring at top of the shaft at a depth of 84.4 ft. and heading 240.4

The seal plate is at 82 feet of depth. Substantial sediment was located on the seal plate making inspection impossible. The ROV was flown around the seal allowing the frame of the ROV to plow the sediment off of the seal. This combined with the disturbance from the thrusters cleared most of the sediment from the seal plate. The seal plate had no signs of corrosion and all fasteners were flush with the surface of the seal.



Figure 25 - Hemispherical bulkhead seal plate after cleaning at a depth of 82.0 ft. and heading 103.7

When the shaft inspection was completed, the horizontal section inspection was resumed. The ROV followed the right springline from the elbow to the fixed wheel gate. The joint condition was the same as observed on Day 1 when inspecting the crown. The crown was re-inspected during the return trip. No photogrammetric data was collected in the horizontal section.



Figure 26 - Painted "4" on crown at a depth of 216 ft. and heading 310.2

Four laser scans were made at the feathered joint between the bottom of the vertical shaft and the top of the elbow. This joint had some spalling and/or wear along the edges.

4.10 Dive Five

Dive five was performed on October 25th. The water elevation at the start of the dive was 2186 ft. It included the visual inspection of the elbow, the trash racks, and portions of exterior of the intake structure as well as laser scans of the bulkhead seal plate. A small diameter wire rope was observed hanging over the top of the vertical conduit and the bulkhead seal plate between columns 4 and 5 extending to a depth of 95 feet. The wire rope was about 4 mm (0.16 inch) in diameter.

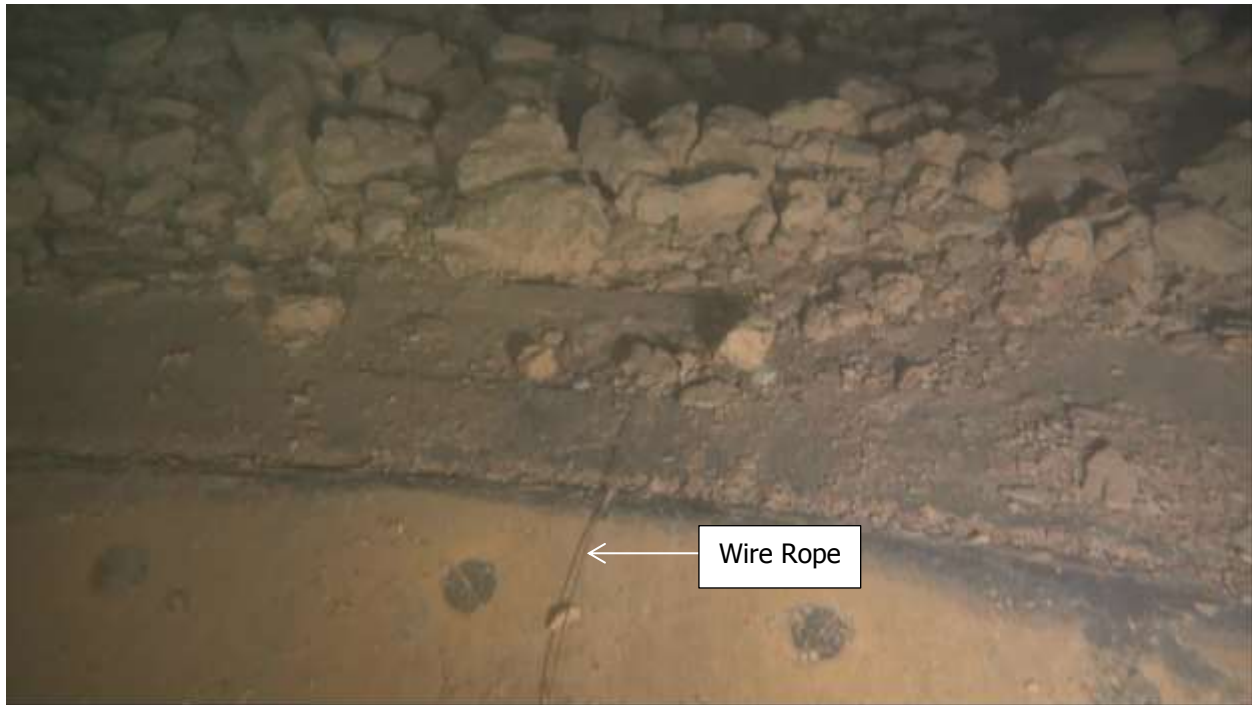


Figure 27 - Uppermost visible portion of Wire Rope at a depth of 81.9 ft. and heading 17.7



Figure 28- Bottom of Wire rope at a depth of 94.9 ft. and heading 34.2

The laser scans of the bulkhead seal were performed at the location of each column and between the columns. The vehicle surfaced after the laser inspections to remove the laser.

4.10.1 Interior Trash Rack Inspection

The trash racks were first inspected from the interior of the structure. The inspection started at the water surface in a counter clockwise rotation, one rack at a time. There are a total of 8 sets of 14 racks stacked on each other. The water level was at about the interface between the fourth and fifth rack from the top. The top three trash racks were lifted for provide the gap for the ROV to enter. Once the set of 8 racks at water surface were inspected the remaining trash racks were inspected by trash rack slot, numbering the slots from the bottom up. Each trash rack slot held two trash racks. The first trash rack slot inspected held the ninth and tenth trash racks from the bottom or the fifth and sixth trash racks from the top. Each trash rack slot was inspected horizontally between columns, alternating between top to bottom and bottom to top, before moving to the next trash rack slot. After this the fourth trash rack slot from the bottom (Trash Racks 7 and 8) was inspected and down to the bottom of the trash racks.



Figure 29 - Typical trash rack condition with some sediment on horizontal member between columns 3 and 4 on first trash rack slot at a depth of 67.5 ft. and heading 60.0.



Figure 30 - Buoy on outside of first trash rack slot between column 4 and 5 at a depth of 67.5 ft. and heading 64.6

In the first trash rack slot between columns 4 and 5 there was a buoy stuck near the top of the trash rack at depth 67.5 ft. In addition to the buoy, some wood debris was stuck in the rack and/or on a ledge outside of the trash racks in trash rack slot 1 in all of the trash racks except for between columns 1 and 2. The rack sections between columns 1 and 8 and columns 5 and 6 had a gap between trash racks 1 and two in the first trash rack slot. After the interior trash rack inspection was completed, the ROV returned to the surface and was hoisted out of the structure for the exterior inspection.

4.10.2 Exterior Trash Rack and Intake Structure Inspection

The exterior inspection of the trash racks did not reveal anything not previously noted in the interior inspection. The vertical section of the intake structure below the trash racks consists of 8 concrete inclined columns or buttresses and three horizontal members referred to as webs. Each buttress was inspected vertically and the webs were inspected on both the top and bottom side. The buttresses extend in line with the columns and use the same numbering. The top of each web was covered with a thick

covering of sediment. The concrete was free of cracks and spalling. A steel conduit was located near the bottom of buttress 8, which continued to the right side of the buttress as seen in Figure 32.



Figure 31 – First web, from the bottom, right side of buttress 8 at a depth of 174.2 ft. and heading 31.8



Figure 32 - Steel conduits on buttress 8 continuing around the right side at a depth of 198.8 ft. and heading 10.2

After the buttresses and webs were inspected the ROV systems were demobilized and the trash rack section lowered back into place. The coal tar coating on the trash racks was still evident and did not need to be repaired.

5 Calibration

The HD camera was calibrated with the Customer supplied target on October 25th 2015. Three video files were generated. Each video file is with the target at a different orientation as requested in the solicitation. The test was performed using sunlight to light the target at was performed near the water surface.

6 Laser Scans

3D models were created from the laser scans of the fixed wheel gate, the transition from the vertical section to the elbow and the hemispherical bulkhead seal. The 3D files accompany this report in electronic format (.ply). 10 scans of the fixed wheel gate were combined to create the 3d model shown in Figure 33. A plane was fit to the smooth areas of the gate and the colors represent the distance from the plane. The red areas are shadows from the ROV and areas limited by the poor visibility due to turbidity. Figure 33 is the model with the brightness of the color representing the reflected signal strength. There is a scale for the colors on the image, with blue being the closest to the plane and red being the furthest. The numbers on the scale are in inches.

Laser intensity is measured in W/cm².

$$\text{Intensity} \left[\frac{\text{Watts}}{\text{cm}^2} \right] = \frac{\text{Laser peak power [W]}}{\text{Effective focal spot area [cm}^2\text{]}}$$

The laser used has a range resolution of 0.01mm at 0.21m, 0.2mm at 1.4m, and 0.6mm at 2.5m.

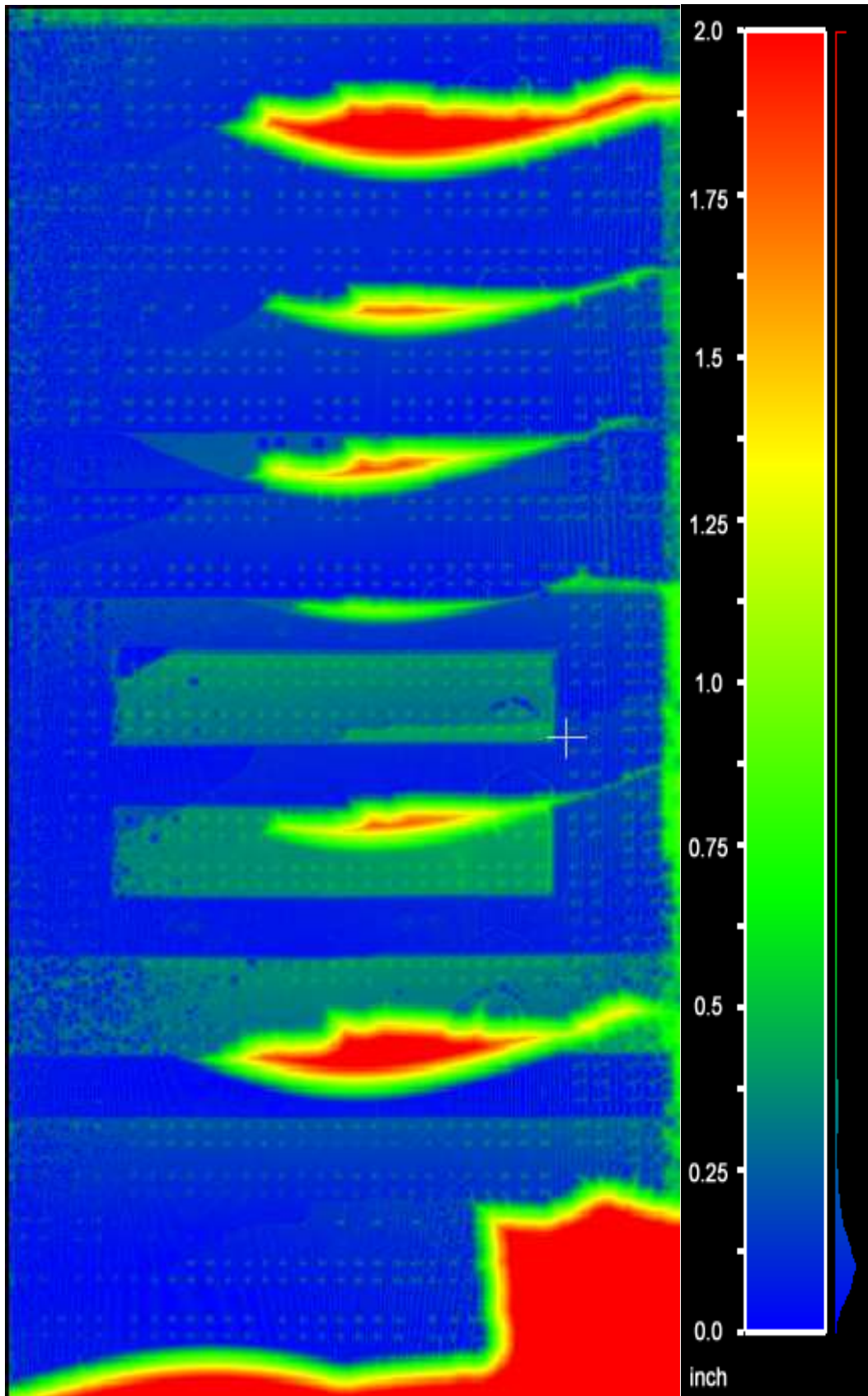


Figure 33 - Difference model of the fixed wheel gate

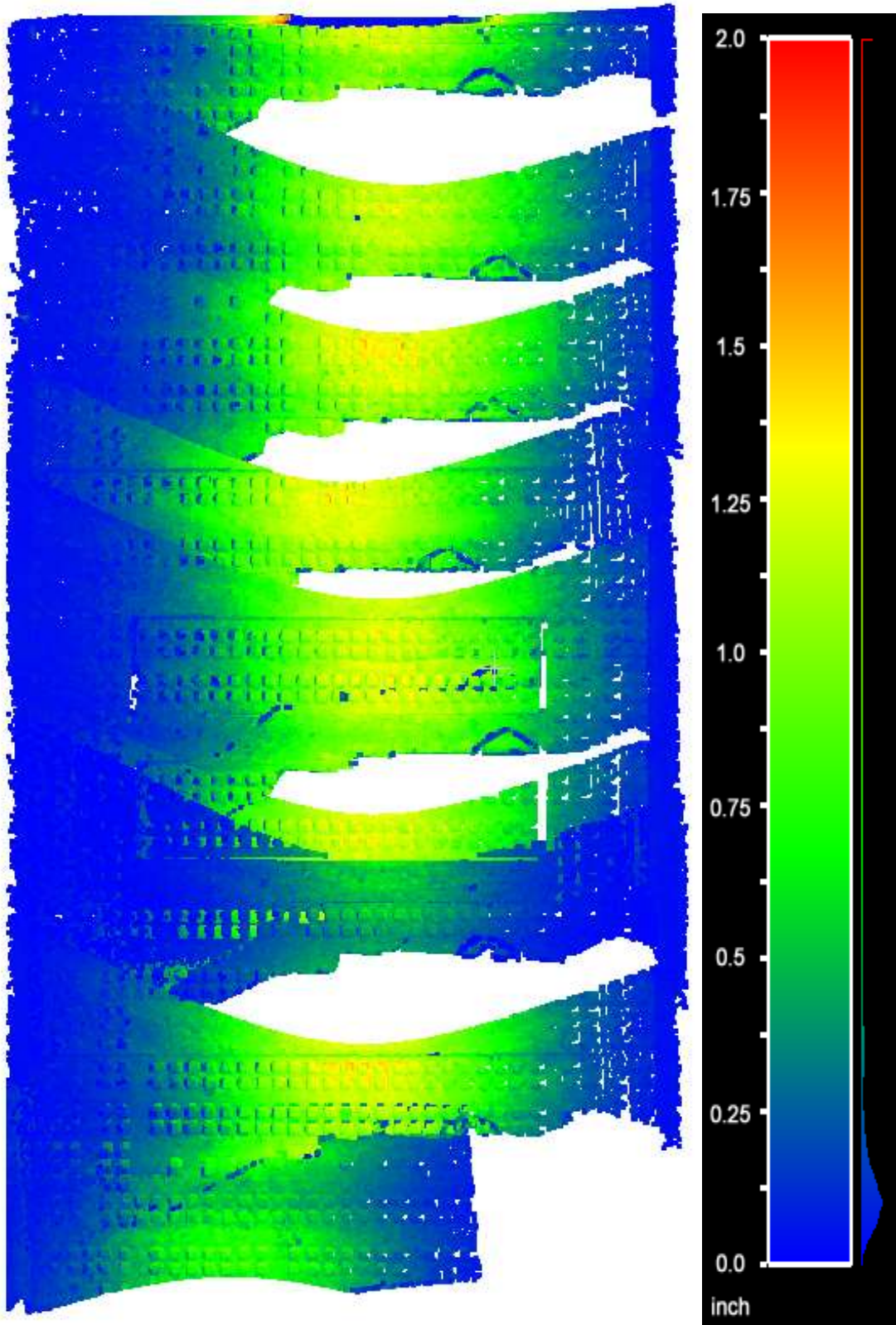


Figure 34 - Degree of reflectance model of the fixed wheel gate laser scan data

The joint between the elbow and the bottom of the shaft was imaged with four scans. The four scans didn't overlap due to turbidity of the water. The interior diameter of the tunnel is 16 feet at this area. The scans conformed to an ideal cylinder with little error. The joint can be seen in all four scans and was consistent. The joint had little to no spalling or separation.

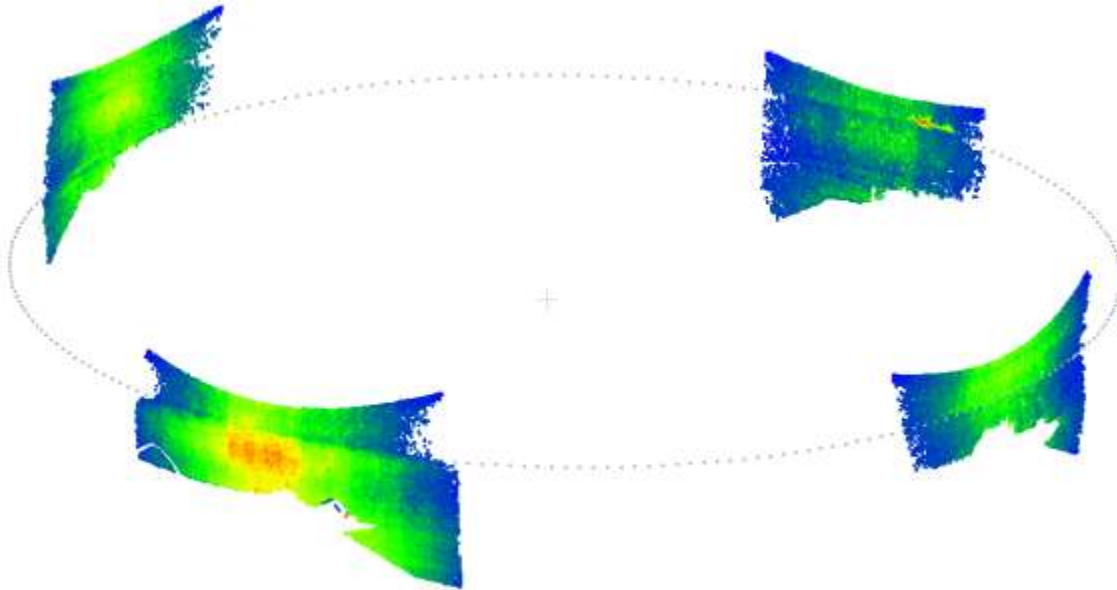


Figure 35 - Composite 3D model (degree of reflectance) of the joint between the vertical shaft and the elbow

16 scans were composited to show the overall shape of the top of the concrete intake structure and the hemispherical bulkhead seal plate. The columns are shown in plan view in Figure 37. Figure 38 shows a difference model between the 3D model and a plane fitted to the bottom of the model that shows the deviation of the seal plate. The seal plate doesn't appear to be out of round or warped. If the model were out of round, the difference model gradient would appear egg-shaped. And if the model were warped, radial discrepancies would appear.

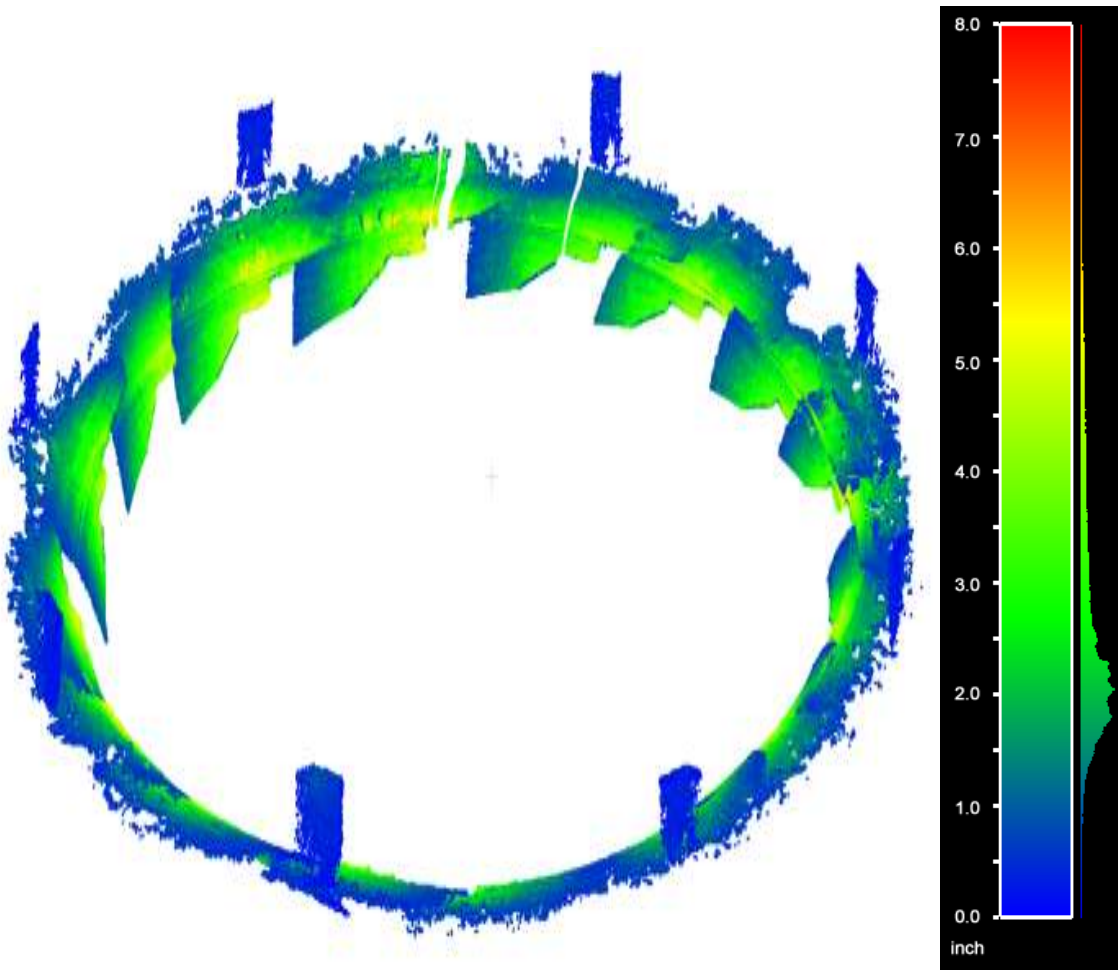


Figure 36 - Laser scan composite of seal plate

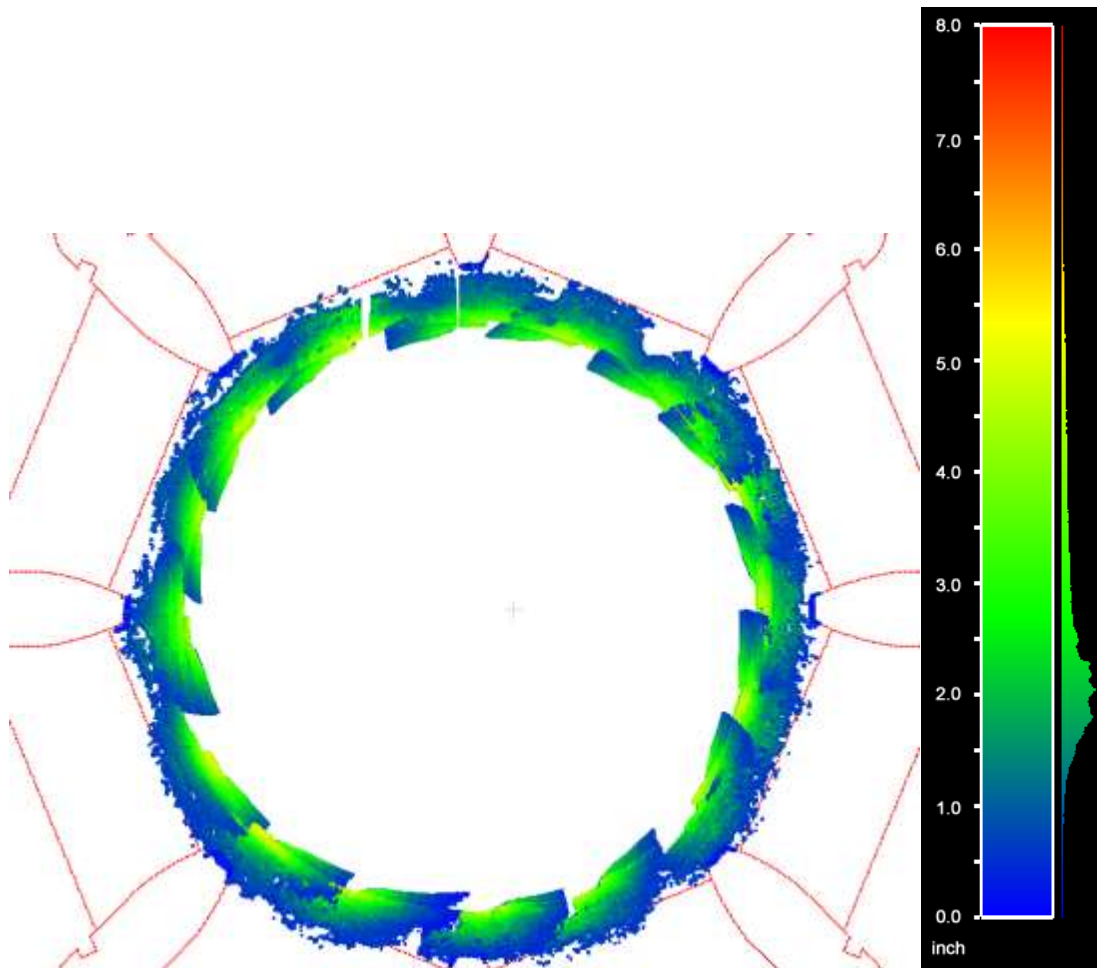


Figure 37 - Plan view of the laser data with columns drawn

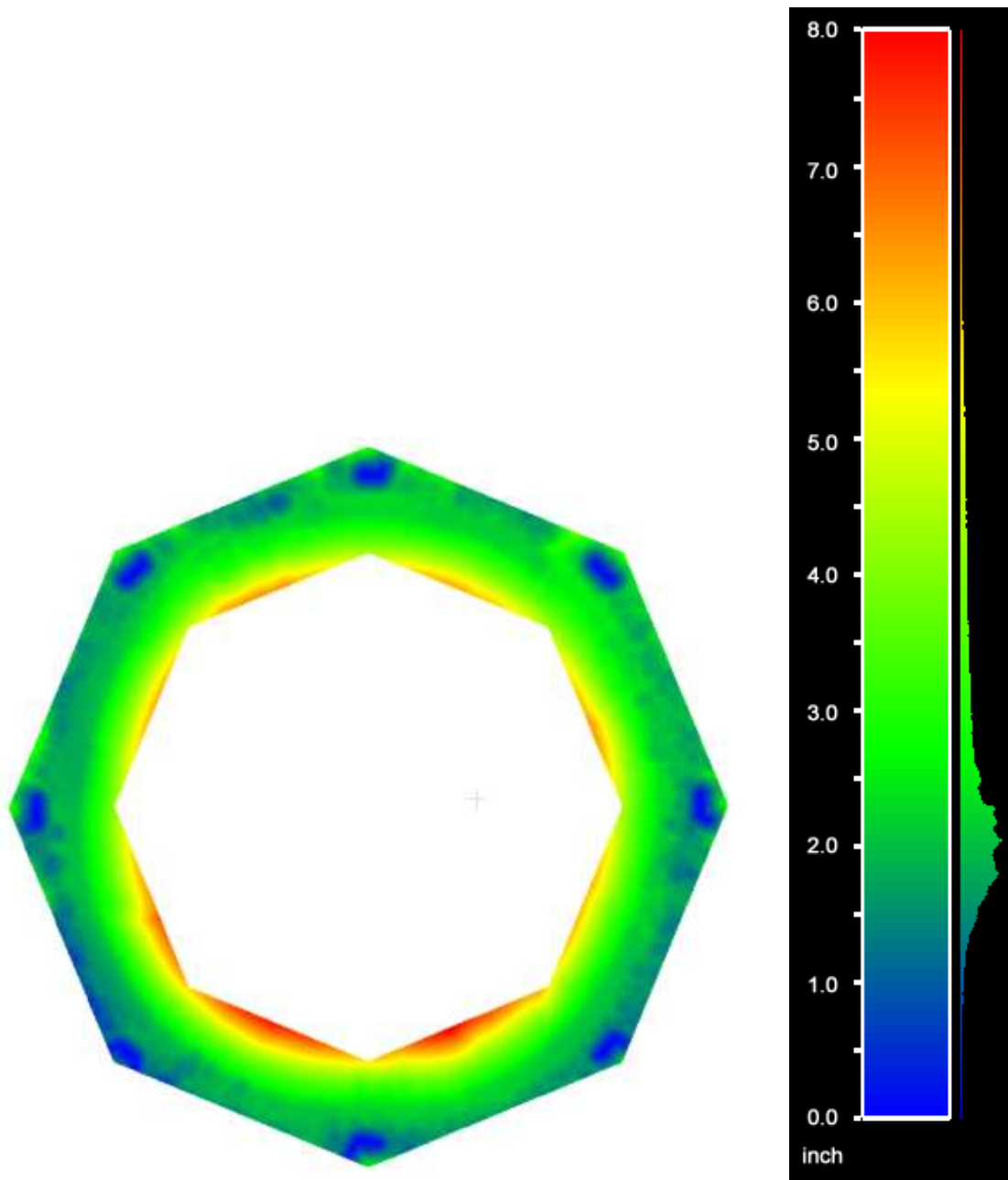


Figure 38 - Difference model of the seal and surrounding area

7 Inspection Video

The inspection generated HD video, observations and laser data. The inspection video was recorded with a special video system that allowed for synchronized video with written notes. The video can be played with any MP4 capable player or can be played back with SubCDivePlayer to view the inspection notes simultaneously with the video. If the video is viewed outside the SubCDivePlayer, the inspection notes in Appendix #2 will have to be manually referred. The instructions to operate the player are in Appendix #1

8 Appendix #1 - SubCDivePlayer Data Recording System

The video and written notes were recorded using SubCDivePlayer. This allows the video of the inspection to be synchronized with the observation notes and simplifies review after the inspection. Figure 41 shows a screenshot of the video with one video channel and the corresponding notes. The program is organized so that it can be played continuously from start to finish or jump to the location of a note by clicking on the note. This makes reviewing important features much faster without having to search through hours or days of video. The data and review program are supplied on a portable hard drive that is compatible with any windows computer with a USB port.



Figure 39 – SubCDivePlayer Screen Layout during playback

8.1 Using the Data Reviewing Program: SubCDivePlayer.exe

Hard Drive Contents

The portable USB hard drive accompanying this report includes viewing software along with all of the data.

The drive is organized with the following file structure:

<drive letter>:\SubCDivePlayer5.0b.exe

<drive letter>:\Trinity Video

Opening "SubCDivePlayer5.0b.exe" will install the program to view the synchronized inspection video and notes. The "Trinity Video" folder contains all of the data for the SubCDivePlayer program.

Opening the Viewer Program

To open the "Viewer" program for the first time after installing, launch "SubCDivePlayer". Expand SubC Dive Log by clicking on the arrow and click Open Existing. Select the .sdl file that is located within the HD folder in the dive that you wish to view and this will load all the notes and video.

Example: <drive letter>:\Trinity Video\Dive (1-5)\HD\Dive (1-5).sdl

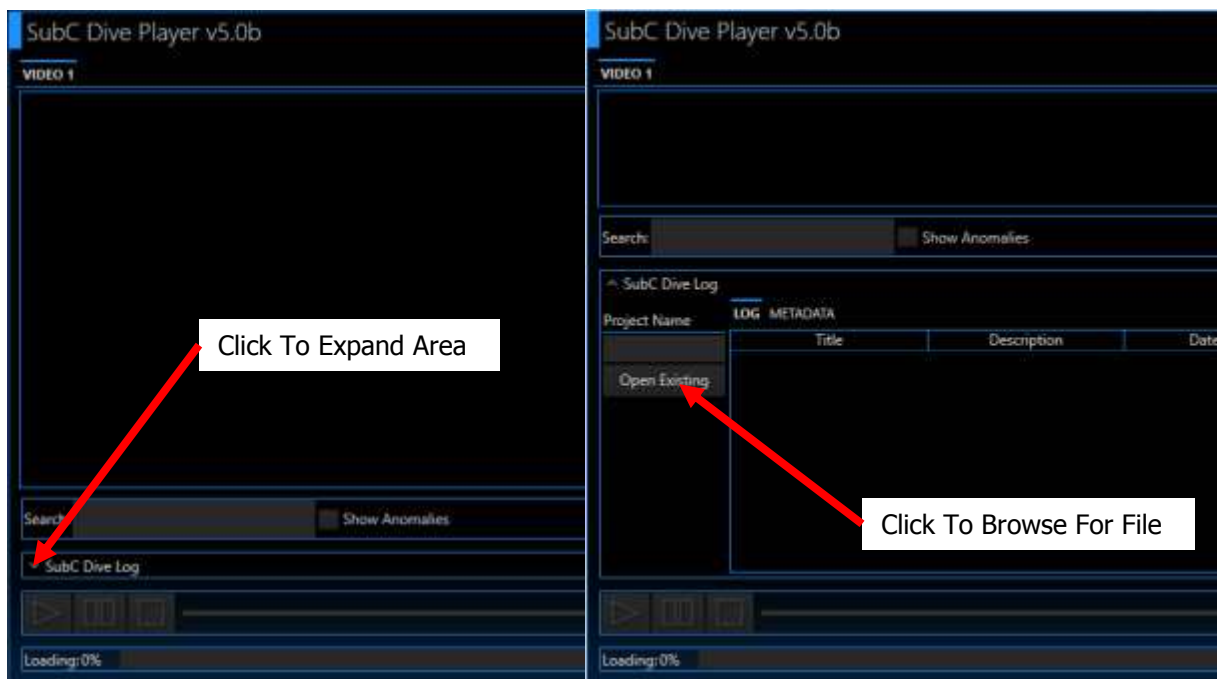


Figure 40 - SubCDivePlayer - Opening a file

8.2 Using SubCDivePlayer

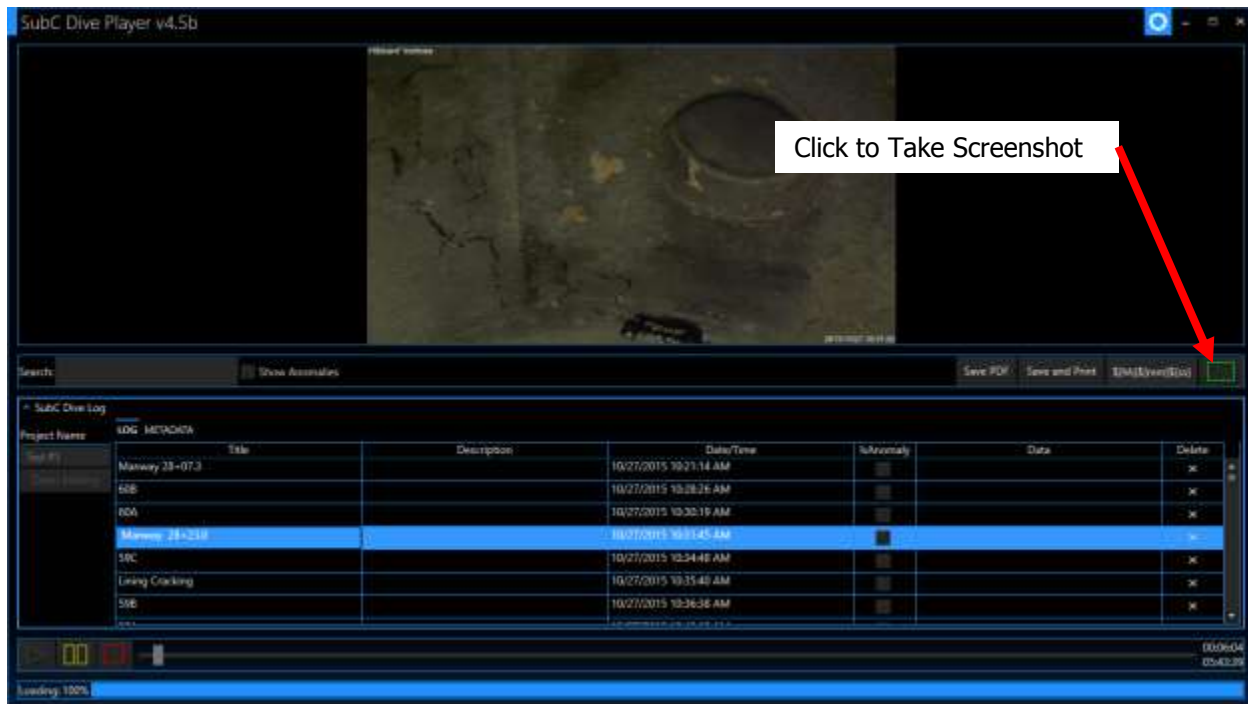


Figure 41 - SubCDivePlayer - Video capture

After loading the inspection data, SubCDivePlayer will look like the Figure 41. Here, a list of all the field notes is generated, each of which can be clicked to guide the user to the selected corresponding video. During play back, the green rectangle on the middle right of the screen can be clicked to take a screen shot of the current video frame. A play/pause button is located in the bottom left of the program and a slider bar is adjacent to the play/pause button to independently control the video. The screen shots will be saved in a screenshot folder generated in the same folder as the .sdl file that was previously loaded, e.g.

<drive letter>:\Trinity Video\Dive (number 1-5)/HD/DivePlayerStills

8.3 File Structure

The inspection data is delivered on a portable hard drive in the following file breakdown:

Drive:\MK	Samples of unprocessed inspection video delivered onsite
Drive:\Report	Report and associated files
Drive:\Trinity Laser	Raw laser scan data
Drive:\Trinity SubC Videos	Shortcuts to SubCDivePlayer SDL (inspection notes) files for playback
Drive:\Trinity Video	Video, Sonar video, and Video captures and SDL files for playback
Drive:\Trinity 3D Models	Processed laser 3D models

9 Appendix #2 – Report Images

Figure	Description	File Time	Video File Name
1	Open trash rack location and HD video column labeling system		Drawing
2	Column labeling for laser scans		Drawing
3	Trash rack jacks installed and racks open with ROV on floating platform		Photo
4	Third column and sediment on bulkhead seal at a depth of 81 ft. and heading 103.7	1632	<Drive>:\Trinity Video\Dive One\HD\Videos\205140.mp4
5	Bulkhead seal plate partially visible under sediment at a depth of 81.5 ft. and heading 103.7	1717	<Drive>:\Trinity Video\Dive One\HD\Videos\205140.mp4
6	Fourth cross member from top on trash rack between column 1 and 8	2143	<Drive>:\Trinity Video\Dive One\HD\Videos\205140.mp4
7	Joint visible through sediment on invert	13	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 151728.mp4
8	Upper edge of right roller plate on Fixed Wheel Gate	581	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 154728.mp4
9	Bottom of left seal plate on Fixed Wheel Gate	315	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 155728.mp4
10	Top left seal plate on Fixed Wheel Gate	365	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 155728.mp4
11	Air vent downstream of gate	224	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 160728.mp4
12	Exposed aggregate downstream of right roller plate	493	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 160728.mp4
13	Exposed aggregate on invert downstream of the bottom right seal plate	186	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 161728.mp4
14	Joint at bottom of shaft and top of elbow	539	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 152728.mp4
15	Exposed aggregate at joint in shaft on second 360 from bottom	539	<Drive>:\Trinity Video\Dive Two\HD\Videos\ 174728.mp4
16	Crown of tunnel at end of elbow at a depth of 214.1 ft. and heading 131.5	557	<Drive>:\Trinity Video\Dive Three\HD\Videos\134550.mp4
17	Joint at crown with white biological coating at a depth of 215.8 ft. and heading 153.8	189	<Drive>:\Trinity Video\Dive Three\HD\Videos\135550.mp4
18	Paint on crown at a depth of 218.8 ft. and heading 156.4	128	<Drive>:\Trinity Video\Dive Three\HD\Videos\141550.mp4
19	Top left of roller gate at a depth of 225.2 ft. and heading 177.2	504	<Drive>:\Trinity Video\Dive Three\HD\Videos\141550.mp4
20	Joint and downline in shaft at a depth of 198.7 ft. and heading 173.4	13	<Drive>:\Trinity Video\Dive Four\HD\Videos\091851.mp4

Figure	Description	File Time	Video File Name
21	Tie rod bolt hole in concrete at a depth of 120.1 ft. and heading 234.8	290	<Drive>:\Trinity Video\Dive Four\HD\Videos\112851.mp4
22	Honeycombed concrete featuring exposed aggregate at a depth of 94.5 ft. and heading 216.6	291	<Drive>:\Trinity Video\Dive Four\HD\Videos\142813.mp4
23	8 inch air supply vent at a depth of 86.5 ft. and heading 128.6	325	<Drive>:\Trinity Video\Dive Four\HD\Videos\143813.mp4
24	Transition from concrete to steel ring at top of the shaft at a depth of 84.4 ft. and heading 240.4	25	<Drive>:\Trinity Video\Dive Four\HD\Videos\144813.mp4
25	Hemispherical bulkhead seal plate after cleaning at a depth of 82.0 ft. and heading 103.7	322	<Drive>:\Trinity Video\Dive Four\HD\Videos\144813.mp4
26	Painted "4" on crown at a depth of 216 ft. and heading 310.2	195	<Drive>:\Trinity Video\Dive Four\HD\Videos\161813.mp4
27	Uppermost visible portion of Wire Rope at a depth of 81.9 ft. and heading 17.7	421	<Drive>:\Trinity Video\Dive Five\HD\Videos\080208.mp4
28	Bottom of Wire rope at a depth of 94.9 ft. and heading 34.2	470	<Drive>:\Trinity Video\Dive Five\HD\Videos\080208.mp4
29	Typical trash rack condition with some sediment on horizontal member between columns 3 and 4 on first trash rack slot at a depth of 67.5 ft. and heading 60.0.	295	<Drive>:\Trinity Video\Dive Five\HD\Videos\152005.mp4
30	Buoy on outside of first trash rack slot between column 4 and 5 at a depth of 67.5 ft. and heading 64.6	295	<Drive>:\Trinity Video\Dive Five\HD\Videos\152005.mp4
31	First web, from the bottom, right side of buttress 8 at a depth of 174.2 ft. and heading 31.8	151	<Drive>:\Trinity Video\Dive Five\HD\Videos\173758.mp4
32	Steel conduits on buttress 8 continuing around the right side at a depth of 198.8 ft. and heading 10.2	393	<Drive>:\Trinity Video\Dive Five\HD\Videos\173758.mp4
33	Difference model of the fixed wheel gate		Laser model
34	Degree of reflectance model of the fixed wheel gate laser scan data		Laser model
35	Composite 3D model (degree of reflectance) of the joint between the vertical shaft and the elbow		Laser model
36	Laser scan composite of seal plate		Laser model
37	Plan view of the laser data with columns drawn		Laser model
38	Difference model of the seal and surrounding area		Laser model
39	SubCDivePlayer Screen Layout during playback		Snapshot
40	SubCDivePlayer - Opening a file		Snapshot
41	SubCDivePlayer - Video capture		Snapshot

10 Appendix # 3 - Inspection Notes

The notes taken during the inspection are contained within the SubCDivePlayer files. The complete list of the notes is shown below, divided into Dives.

10.1 Dive 1

Date	Time	Description	File Time	Data Type	Video File Name
10/20/2015	20:54:46	Depth 20	186	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	20:56:16	Depth 50	276	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	20:57:17	Depth 75	337	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:04:07	Stop for scan at 85 ft. just below seal	747	Laser	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:16:43	Visual of part of seal	1503	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:18:52	Third column counter clockwise	1632	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:19:55	Fourth column counter clockwise	1695	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:20:17	Seal is covered by sediment	1717	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:20:32	Fifth column	1732	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:21:11	Sixth column	1771	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:21:37	Seventh column	1797	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:22:06	Eighth column	1826	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:22:27	Seal plate exposed	1847	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4

Date	Time	Description	File Time	Data Type	Video File Name
10/20/2015	21:24:37	First column inspection of full seal complete	1977	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:25:22	Column eight	2022	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:26:17	Trash rack between column 8 and 1 third cross member from bottom	2078	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:27:23	Fourth cross member from column 1 to 8	2143	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:28:15	Fifth cross member from column 8 to 1	2195	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4
10/20/2015	21:29:07	End inspection for day return to surface	2247	Video	F:\Trinity Video\Dive One\HD\Videos\205140.mp4

10.2 Dive 2

Date	Time	Description	Data Type	File Time	Video File Name
10/22/2015	17:58:05	Start of video	Video	37	F:\Trinity Video\Dive Two\HD\Videos\144728.mp4
10/22/2015	17:59:49	Downline at surface	Video	141	F:\Trinity Video\Dive Two\HD\Videos\144728.mp4
10/22/2015	18:02:38	Bottom of downline on Bulkhead seal	Video	310	F:\Trinity Video\Dive Two\HD\Videos\144728.mp4
10/22/2015	18:06:11	Joint at top of elbow and bottom of shaft	Video	523	F:\Trinity Video\Dive Two\HD\Videos\144728.mp4
10/22/2015	18:06:49	Sediment on bottom of shaft	Video	561	F:\Trinity Video\Dive Two\HD\Videos\144728.mp4
10/22/2015	18:07:15	Tether visible in elbow	Video	587	F:\Trinity Video\Dive Two\HD\Videos\144728.mp4
10/22/2015	18:08:16	Tether slack removed	Video	48	F:\Trinity Video\Dive Two\HD\Videos\145728.mp4
10/22/2015	18:08:52	Start flight to roller gate	Video	84	F:\Trinity Video\Dive Two\HD\Videos\145728.mp4
10/22/2015	18:09:49	Right wall	Video	141	F:\Trinity Video\Dive Two\HD\Videos\145728.mp4
10/22/2015	18:11:01	Invert of tunnel	Video	213	F:\Trinity Video\Dive Two\HD\Videos\145728.mp4
10/22/2015	18:27:41	Joint on invert	Video	13	F:\Trinity Video\Dive Two\HD\Videos\151728.mp4
10/22/2015	18:43:54	Parked on bottom	Video	386	F:\Trinity Video\Dive Two\HD\Videos\152728.mp4
10/22/2015	19:01:41	Moving to right gate slot	Video	253	F:\Trinity Video\Dive Two\HD\Videos\154728.mp4

Date	Time	Description	Data Type	File Time	Video File Name
10/22/2015	19:02:57	Right gate slot	Video	329	F:\Trinity Video\Dive Two\HD\Videos\154728.mp4
10/22/2015	19:04:12	Bottom right gate guide	Video	404	F:\Trinity Video\Dive Two\HD\Videos\154728.mp4
10/22/2015	19:05:24	Bottom right roller plate	Video	476	F:\Trinity Video\Dive Two\HD\Videos\154728.mp4
10/22/2015	19:06:18	Roller plate from bottom to top	Video	530	F:\Trinity Video\Dive Two\HD\Videos\154728.mp4
10/22/2015	19:07:09	Clear visibility of right roller plate	Video	581	F:\Trinity Video\Dive Two\HD\Videos\154728.mp4
10/22/2015	19:07:15	Bottom of roller gate in up position at right roller plate	Video	587	F:\Trinity Video\Dive Two\HD\Videos\154728.mp4
10/22/2015	19:08:32	Left downstream side of gate	Video	64	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:08:56	Upstream left side of gate bottom	Video	88	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:09:58	Bottom of left roller plate	Video	150	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:11:02	Top of left roller plate	Video	214	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:11:10	Upstream left side of gate	Video	222	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4

Date	Time	Description	Data Type	File Time	Video File Name
10/22/2015	19:11:30	Left seal plate top to bottom	Video	242	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:12:43	Bottom of left seal plate	Video	315	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:13:33	Top of left seal plate	Video	365	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:13:36	Top seal from left to right	Video	368	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:14:23	Top seal right side	Video	415	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:14:25	Right Seal top to bottom	Video	417	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:15:12	Right Seal bottom	Video	464	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:15:34	Right roller plate bottom to top	Video	486	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:16:21	Right roller plate top	Video	533	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:16:40	Upstream side of gate slot from right to left	Video	552	F:\Trinity Video\Dive Two\HD\Videos\155728.mp4
10/22/2015	19:18:03	Upstream side of gate slot left side	Video	35	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:18:55	Bottom of left roller plate	Video	87	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:20:23	Top of left roller plate	Video	175	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4

Date	Time	Description	Data Type	File Time	Video File Name
10/22/2015	19:21:12	Air vent pipe downstream of gate slot	Video	224	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:23:36	Right roller plate	Video	368	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:24:05	Small locations with exposed aggregate downstream of right roller plate	Video	397	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:25:41	Small location of exposed aggregate downstream of right roller plate	Video	493	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:26:22	Bottom or right roller plate	Video	534	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:26:58	Bottom of right seal plate	Video	570	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:27:03	Facing upstream with bottom seal plate below camera view	Video	575	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4
10/22/2015	19:27:09	Bottom seal plate	Video	581	F:\Trinity Video\Dive Two\HD\Videos\160728.mp4

Date	Time	Description	Data Type	File Time	Video File Name
10/22/2015	19:29:29	Right side of bottom seal plate facing upstream going to left	Video	121	F:\Trinity Video\Dive Two\HD\Videos\161728.mp4
10/22/2015	19:30:34	Left side of bottom seal	Video	186	F:\Trinity Video\Dive Two\HD\Videos\161728.mp4
10/22/2015	19:36:56	Waiting near gate seal.	Video	568	F:\Trinity Video\Dive Two\HD\Videos\161728.mp4
10/22/2015	19:41:08	Start haul back of tether from roller gate	Video	220	F:\Trinity Video\Dive Two\HD\Videos\162728.mp4
10/22/2015	19:41:16	Follow tether along invert from gate to elbow	Video	228	F:\Trinity Video\Dive Two\HD\Videos\162728.mp4
10/22/2015	19:42:09	Move from invert to left springline towards elbow	Video	281	F:\Trinity Video\Dive Two\HD\Videos\162728.mp4
10/22/2015	19:45:35	Joint from invert to the left springline	Video	487	F:\Trinity Video\Dive Two\HD\Videos\162728.mp4
10/22/2015	19:46:37	Joint at crown	Video	549	F:\Trinity Video\Dive Two\HD\Videos\162728.mp4
10/22/2015	19:47:48	Return to invert	Video	20	F:\Trinity Video\Dive Two\HD\Videos\163728.mp4
10/22/2015	20:36:13	Elbow bend with clean spots from tether	Video	525	F:\Trinity Video\Dive Two\HD\Videos\171728.mp4

Date	Time	Description	Data Type	File Time	Video File Name
10/22/2015	20:29:43	Crown of tunnel at elbow	Video	135	F:\Trinity Video\Dive Two\HD\Videos\171728.mp4
10/22/2015	20:31:51	Joint	Video	263	F:\Trinity Video\Dive Two\HD\Videos\171728.mp4
10/22/2015	20:44:06	Clean area on wall from tether	Video	398	F:\Trinity Video\Dive Two\HD\Videos\172728.mp4
10/22/2015	20:46:27	Joint at top of elbow bottom of shaft	Video	539	F:\Trinity Video\Dive Two\HD\Videos\172728.mp4
10/22/2015	20:53:35	End of 360 at top of elbow joint	Video	393	F:\Trinity Video\Dive Two\HD\Videos\173728.mp4
10/22/2015	20:53:50	Start of 360 below top elbow joint	Video	408	F:\Trinity Video\Dive Two\HD\Videos\173728.mp4
10/22/2015	20:58:50	Orange paint on wall of shaft	Video	82	F:\Trinity Video\Dive Two\HD\Videos\174728.mp4
10/22/2015	20:57:35	Joint at bottom of shaft and top of elbow	Video	7	F:\Trinity Video\Dive Two\HD\Videos\174728.mp4
10/22/2015	20:59:18	Starting 2nd 360 below top of elbow joint	Video	110	F:\Trinity Video\Dive Two\HD\Videos\174728.mp4
10/22/2015	21:01:50	Spalling at joint	Video	262	F:\Trinity Video\Dive Two\HD\Videos\174728.mp4
10/22/2015	21:03:03	Exposed aggregate at joint	Video	335	F:\Trinity Video\Dive Two\HD\Videos\174728.mp4
10/22/2015	21:06:27	Exposed aggregate at joint	Video	539	F:\Trinity Video\Dive Two\HD\Videos\174728.mp4

Date	Time	Description	Data Type	File Time	Video File Name
10/22/2015	21:10:35	Filled bolt hole	Video	187	F:\Trinity Video\Dive Two\HD\Videos\175728.mp4
10/22/2015	21:16:41	3rd rotation below top of elbow	Video	553	F:\Trinity Video\Dive Two\HD\Videos\175728.mp4
10/22/2015	21:22:34	4th rotation below top of elbow	Video	306	F:\Trinity Video\Dive Two\HD\Videos\180728.mp4
10/22/2015	21:28:32	Mark on wall from tether removing fouling	Video	64	F:\Trinity Video\Dive Two\HD\Videos\181728.mp4
10/22/2015	21:28:46	Start 5th rotation below top of elbow	Video	78	F:\Trinity Video\Dive Two\HD\Videos\181728.mp4
10/22/2015	21:32:47	End dive and on surface	Video	319	F:\Trinity Video\Dive Two\HD\Videos\181728.mp4

10.3 Dive 3

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	13:26:05	Start Dive	9.4	309.2	Video	15	F:\Trinity Video\Dive Three\HD\Videos\132550.mp4
10/23/2015	13:26:15	Follow column 1 with downline to bottom	10.9	276.3	Video	25	F:\Trinity Video\Dive Three\HD\Videos\132550.mp4
10/23/2015	13:27:52	At 50ft depth	58.5	255.4	Video	121	F:\Trinity Video\Dive Three\HD\Videos\132550.mp4
10/23/2015	13:28:56	Seal for hemispherical bulkhead at 82 ft. depth	81.6	189.6	Video	185	F:\Trinity Video\Dive Three\HD\Videos\132550.mp4
10/23/2015	13:33:16	Moving weight for downline off of ledge at 82 ft. depth	82.5	76.5	Video	446	F:\Trinity Video\Dive Three\HD\Videos\132550.mp4
10/23/2015	13:36:21	Downline weight on bottom	83.5	309.3	Video	30	F:\Trinity Video\Dive Three\HD\Videos\133551.mp4
10/23/2015	13:37:59	Follow downline to bottom of elbow	98.9	166.5	Video	129	F:\Trinity Video\Dive Three\HD\Videos\133551.mp4
10/23/2015	13:38:48	At 145 ft. depth	145.3	130.3	Video	177	F:\Trinity Video\Dive Three\HD\Videos\133551.mp4
10/23/2015	13:40:47	Downline on bottom	217.9	329.9	Video	296	F:\Trinity Video\Dive Three\HD\Videos\133551.mp4
10/23/2015	13:42:55	Sediment at downline	221.7	347.9	Video	424	F:\Trinity Video\Dive Three\HD\Videos\133551.mp4
10/23/2015	13:54:56	Zero counter set in tunnel and checked with sonar from back wall	214.3	175.9	Video	545	F:\Trinity Video\Dive Three\HD\Videos\134550.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	13:55:08	Start crown inspection from elbow to gate	214.1	136.4	Video	558	F:\Trinity Video\Dive Three\HD\Videos\134550.mp4
10/23/2015	13:56:26	Joint	214.7	161.7	Video	36	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:56:39	Joint	215.4	163.4	Video	48	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:57:34	Joint	218.4	117.9	Video	104	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:57:36	White patch at 11 o'clock upstream of Joint	219.2	126.1	Video	105	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:58:21	Joint	215.4	197.1	Video	151	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:58:39	Joint	215.9	153.7	Video	169	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:59:00	Joint	215.3	161.7	Video	189	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:59:13	Joint	217.5	153.7	Video	202	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:59:38	Joint	215.8	153	Video	228	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	13:59:47	Joint	215.8	158.7	Video	236	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:00:25	Joint	215	160.2	Video	275	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:00:36	Joint	214.9	152.7	Video	285	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:00:50	Joint	215.3	161.4	Video	300	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:00:57	Joint	215.3	169.2	Video	307	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:01:06	Joint	216	164.2	Video	315	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:01:13	Joint	215.5	157.4	Video	323	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:01:22	Joint	215.6	151.5	Video	332	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:01:47	Joint	215.4	160	Video	357	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:01:54	Joint	215.6	154.1	Video	363	F:\Trinity Video\Dive

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
							Three\HD\Videos\135550.mp4
10/23/2015	14:02:06	Joint	215.6	118.8	Video	376	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:02:13	Joint	216.3	146.8	Video	382	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:02:21	Joint	215.9	153.5	Video	391	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:02:33	Joint	215.6	158.5	Video	403	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:02:37	Joint	215.9	156.5	Video	407	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:02:45	Joint	216	162.9	Video	414	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:02:51	Joint	215.6	158.9	Video	421	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:02:57	Joint	216.4	156.6	Video	427	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:03:04	Joint	216	160.4	Video	434	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:03:11	Joint	216.2	160.3	Video	441	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:03:16	Joint	216	157.9	Video	446	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:03:23	Joint	215.9	155	Video	453	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:03:29	Joint	216.4	149.3	Video	459	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:03:42	Joint	215.9	156.2	Video	471	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:03:49	Circular white patch on crown	216.3	146.3	Video	478	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:04:03	Joint	215.8	152.3	Video	493	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:04:12	Joint	216.3	157.5	Video	502	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:04:19	Joint	217.1	152.4	Video	508	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:04:44	Joint	215.8	142.2	Video	534	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:04:57	Joint	216.3	142.9	Video	546	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:05:04	Joint	216	152.5	Video	554	F:\Trinity Video\Dive

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
							Three\HD\Videos\135550.mp4
10/23/2015	14:05:16	Joint	216	153.4	Video	566	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:05:24	Joint	216.4	152.5	Video	574	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:05:26	Joint	216.3	153.9	Video	575	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:05:34	Joint	216.8	156	Video	583	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:05:40	Joint	216.8	159	Video	590	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:05:46	Joint	216.8	159.3	Video	596	F:\Trinity Video\Dive Three\HD\Videos\135550.mp4
10/23/2015	14:05:53	Joint	217.5	149.8	Video	2	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:00	Joint	217.2	157.6	Video	9	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:07	Joint	217.7	160.7	Video	17	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:12	Joint	217.1	156.3	Video	21	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:20	Joint	217.2	158.9	Video	30	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:27	Joint	217.7	153.6	Video	36	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:33	Joint	217.6	157	Video	42	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:41	Joint	217.2	154.2	Video	50	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:55	Joint	217.4	155.8	Video	64	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:06:58	Joint	217.2	150.7	Video	67	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:07:02	Joint	217.4	155.6	Video	71	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:07:07	Joint	217.1	151.1	Video	77	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:07:13	Joint	217.1	151	Video	83	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:07:20	Joint	217.1	144.8	Video	89	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:07:39	Joint	217.5	150	Video	108	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	14:07:46	Joint	217.9	154.4	Video	115	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:07:52	Joint	217.4	157.6	Video	122	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:07:59	Joint	217.7	151.9	Video	129	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:08:27	Joint	217	159.4	Video	156	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:08:42	Joint	216.8	154.2	Video	171	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:09:03	Joint	218	155	Video	192	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:09:09	Joint	218.9	155.6	Video	198	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:09:16	Joint	218.3	157	Video	205	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:09:23	Joint	218.3	159.1	Video	213	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:09:43	Joint	217.7	157.9	Video	233	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:09:51	Joint	217.9	160.9	Video	240	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:09:57	Joint	217.6	158.5	Video	247	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:10:04	Joint	217.5	156.2	Video	254	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:10:13	Joint	217.7	156.5	Video	263	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:10:24	Joint	217.9	154.3	Video	273	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:10:30	Joint	217.9	132.4	Video	280	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:10:44	Joint	218.1	154.2	Video	293	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:10:50	Joint	217.9	157.6	Video	300	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:11:04	Joint	218.7	153.6	Video	313	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:11:10	Joint	218.7	145.3	Video	320	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:11:24	Joint	219.6	141.7	Video	334	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:11:31	Joint	218.5	156.1	Video	340	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	14:11:52	Joint	218.4	147.5	Video	362	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:12:11	Joint	218.9	155	Video	381	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:12:18	Joint	218.9	152.9	Video	388	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:12:27	Joint	218.4	152.9	Video	397	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:12:31	Joint	219.6	153.3	Video	401	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:12:41	Joint	219.1	153.3	Video	411	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:12:44	Joint	218.8	152.8	Video	414	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:13:04	Joint	218.1	142.3	Video	434	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:13:11	Joint	217.7	147.3	Video	441	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:13:19	Joint	218	141.9	Video	449	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:13:24	Joint	217.7	140.7	Video	454	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:13:26	Joint	218	141.8	Video	456	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:13:39	Joint	218.4	150.3	Video	469	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:13:45	Joint	218.5	156.4	Video	475	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:14:23	Joint	218.3	155.7	Video	512	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:14:29	Joint	218.1	149.4	Video	519	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:14:49	Joint	218.9	160.8	Video	539	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:14:51	Joint	218.8	155.9	Video	541	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:14:58	Joint	218.1	152.9	Video	547	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:15:07	Joint	217.9	148.3	Video	557	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:15:17	Joint	218.1	141.7	Video	566	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:15:24	Joint	218.8	148.9	Video	574	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	14:15:33	Joint	219.1	165.9	Video	582	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:15:46	Joint	221.2	161.3	Video	596	F:\Trinity Video\Dive Three\HD\Videos\140550.mp4
10/23/2015	14:16:02	Joint	218.1	147.2	Video	11	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:16:13	Joint	218.5	157.4	Video	22	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:16:16	Paint	218.7	142.7	Video	26	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:16:32	Joint	221.2	157.5	Video	42	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:17:32	Joint	218.7	159.4	Video	102	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:17:35	Joint	218.5	152.9	Video	105	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:17:40	Joint	218.3	154	Video	110	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:17:45	Paint	218.5	168.4	Video	115	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:17:52	Joint	219.8	132.2	Video	121	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:17:59	Paint marking "28+20"	220.4	165	Video	128	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:18:47	Joint	220.6	147.3	Video	177	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:19:22	Joint	218.3	164.6	Video	211	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:19:35	Joint	218.4	163.2	Video	225	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:19:44	Joint	219.1	163.4	Video	234	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:19:59	Joint	222.3	154.2	Video	248	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:20:07	Joint	225.2	156.1	Video	257	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:20:10	Taper to gate	225.5	155.7	Video	260	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:20:49	Right wall of taper	227.5	151.8	Video	298	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:20:58	Gate	225.2	153.3	Video	308	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	14:24:15	Top left corner of gate starting pass	225	180.2	Video	504	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:25:00	Right side pass 2	227.2	168.1	Video	550	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:25:50	Left side	226.7	171.7	Video	600	F:\Trinity Video\Dive Three\HD\Videos\141550.mp4
10/23/2015	14:28:39	Left side start pass 3	227.3	157.5	Video	169	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:28:57	Right side	228	149.2	Video	186	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:29:07	Right side start pass 4	228.4	143.4	Video	197	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:29:50	Left side	229.6	154.7	Video	240	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:30:08	Left side start pass 5	229.2	168.1	Video	257	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:30:32	Right side	230.2	168.1	Video	282	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:30:48	Right side start pass 6	230.1	171.7	Video	298	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:31:33	Left side	231	171.9	Video	343	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:31:52	Left side start pass 7	231.3	155.2	Video	361	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:32:34	Right side	231.8	178.9	Video	403	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:33:03	Right side start pass 8	232.1	180.2	Video	432	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:33:21	Left side	232.2	177.7	Video	451	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:33:41	Left side start pass 9	233.1	164.1	Video	470	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:34:08	Right side	233.8	176.7	Video	497	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:34:22	Right side start pass 10	233.6	180.7	Video	512	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:34:45	Left side	234.4	180.8	Video	535	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	14:34:59	Left side start pass 11	234.5	149	Video	549	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:35:24	Right side	236.3	173.9	Video	573	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:35:41	Right side start pass 12	235.6	180.8	Video	591	F:\Trinity Video\Dive Three\HD\Videos\142550.mp4
10/23/2015	14:36:13	Left side	236.5	169.2	Video	23	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:36:22	Left side start pass 13	236.8	148.9	Video	32	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:36:49	Right side	237.2	158.8	Video	59	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:37:12	Right side start pass 14	236.6	174.9	Video	81	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:37:38	Left side	238	167.6	Video	107	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:38:11	Left side start pass 15	237.7	165.9	Video	140	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:38:39	Right side	238.2	160.9	Video	169	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:38:56	Right side start pass 16	238.6	186.1	Video	186	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:39:24	Left side	239.5	176.8	Video	214	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:39:33	Left side start pass 17	239.5	160.4	Video	223	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:40:04	Right side	240.1	169.7	Video	253	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:40:12	Right side start pass 18	240.8	172.1	Video	262	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:40:53	Left side end pass 19	241	164.7	Video	303	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:41:09	On bottom tilt camera for bottom pass	241	164.7	Video	318	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:41:38	Left side start pass 20	241	135.7	Video	348	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:42:05	Right side	241	166.3	Video	375	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	14:42:10	Tilt camera down	241	169.6	Video	380	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:42:27	Right side start pass 21	241	184	Video	397	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:42:49	Left side	241	153.7	Video	418	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:42:54	Tilt camera	241	153	Video	424	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:43:02	Left side start pass 22	241	177.9	Video	431	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:43:35	Right side	241	153.2	Video	465	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:44:32	Follow right corner to top right at 45	231.3	204.5	Video	521	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:45:09	Top right	225	205	Video	559	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:45:45	Follow top right to bottom right at 45	228.9	217.7	Video	594	F:\Trinity Video\Dive Three\HD\Videos\143550.mp4
10/23/2015	14:46:26	Bottom right corner	240.2	220.7	Video	35	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4
10/23/2015	14:47:01	Top right to top left	225	165.1	Video	70	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4
10/23/2015	14:47:30	Top left	224.2	155.9	Video	100	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4
10/23/2015	14:47:36	Top left to bottom left	224.6	121.1	Video	106	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4
10/23/2015	14:49:25	Bottom left	240.8	132.8	Video	214	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4
10/23/2015	14:49:31	Bottom left corner	240.8	134	Video	221	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4
10/23/2015	14:49:41	Bottom left to bottom right	241	148.8	Video	231	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4
10/23/2015	14:50:18	At bottom right corner	240.8	170.1	Video	267	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4
10/23/2015	14:53:19	Stop	240.8	160.6	Video	448	F:\Trinity Video\Dive Three\HD\Videos\144550.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	15:17:55	Start laser scan 2 of right side of gate bottom	241	160.2	Laser	125	F:\Trinity Video\Dive Three\HD\Videos\151550.mp4
10/23/2015	15:33:58	Start laser scan 3 at center bottom of gate	241	166.5	Laser	488	F:\Trinity Video\Dive Three\HD\Videos\152550.mp4
10/23/2015	15:46:46	Finished laser scan at bottom center at depth 241 ft.	241	83.8	Laser	56	F:\Trinity Video\Dive Three\HD\Videos\154550.mp4
10/23/2015	15:51:18	Start laser scan 4 at 2 feet from bottom at depth 239 ft. centered on gate	239.4	74.3	Laser	328	F:\Trinity Video\Dive Three\HD\Videos\154550.mp4
10/23/2015	16:26:00	Start laser scan 5 at 4 feet from bottom at depth 236 ft.	235.9	80.8	Laser	166	F:\Trinity Video\Dive Three\HD\Videos\162314.mp4
10/23/2015	16:54:38	Start laser scan 6 at 6 feet from bottom at depth 232 ft.	232.6	85.6	Laser	84	F:\Trinity Video\Dive Three\HD\Videos\165314.mp4
10/23/2015	17:12:22	Start laser scan 7 at 11 feet from bottom at depth 230 ft.	230.7	80.7	Laser	85	F:\Trinity Video\Dive Three\HD\Videos\171057.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/23/2015	17:24:53	Start laser scan 8 at 13 feet from bottom at depth 228 ft.	228.5	74.4	Laser	235	F:\Trinity Video\Dive Three\HD\Videos\172057.mp4
10/23/2015	17:38:10	Start laser scan 9 at 15 feet from bottom at depth 226 ft.	226.4	72.4	Laser	432	F:\Trinity Video\Dive Three\HD\Videos\173057.mp4
10/23/2015	17:50:55	Start laser scan 10 at top of gate at depth 224.7 ft.	224.8	60.8	Laser	598	F:\Trinity Video\Dive Three\HD\Videos\174058.mp4
10/23/2015	18:02:54	Move to bottom center of gate to image floor to gate interface	241.1	93.3	Laser	117	F:\Trinity Video\Dive Three\HD\Videos\180058.mp4
10/23/2015	18:19:37	Start laser scan of right side of gate bottom	241.1	154.9	Laser	519	F:\Trinity Video\Dive Three\HD\Videos\181057.mp4
10/23/2015	18:28:57	Finished scanning gate	241	152.6	Laser	479	F:\Trinity Video\Dive Three\HD\Videos\182057.mp4
10/23/2015	18:29:06	End inspection for day	241	152.6	Video	489	F:\Trinity Video\Dive Three\HD\Videos\182057.mp4

10.4 Dive 4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	9:19:04	Start circumferential inspection of vertical shaft at 199 ft. depth	198.6	215	Video	13	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:19:30	Downline is on south wall	198.3	187.5	Video	39	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:20:34	Start counter clockwise pass at 199 ft.	198.5	189.2	Video	103	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:21:35	East	198.5	65.6	Video	164	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:22:59	North	198.5	318.7	Video	248	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:23:33	West	198.8	299.1	Video	282	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:24:33	South end pass	198.8	209.3	Video	342	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:26:04	Start clockwise pass at 196.5 ft.	196.5	170.2	Video	433	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:26:51	West	196.6	321.6	Video	480	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:27:55	North	196.2	3.7	Video	544	F:\Trinity Video\Dive Four\HD\Videos\091851.mp4
10/24/2015	9:29:07	East	196	113.9	Video	16	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4
10/24/2015	9:29:49	South	196.5	195.6	Video	58	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4
10/24/2015	9:29:55	End pass at 196.5 ft.	196.5	188.6	Video	64	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4
10/24/2015	9:30:57	Start counter clockwise pass at 194.6 ft.	194.6	199.5	Video	126	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4
10/24/2015	9:32:47	East	194.3	76.1	Video	236	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4
10/24/2015	9:34:05	North	194.5	330.1	Video	314	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	9:34:48	West	194.8	239.2	Video	357	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4
10/24/2015	9:35:38	South end pass at 194.6 ft.	194.8	182.2	Video	407	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4
10/24/2015	9:37:00	Start clockwise pass at 192.4 ft.	192.3	195.2	Video	489	F:\Trinity Video\Dive Four\HD\Videos\092851.mp4
10/24/2015	9:39:14	North	191.9	15.7	Video	23	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:40:25	East	192.4	107.9	Video	94	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:40:58	S end pass at 192.6 ft.	192.2	213.1	Video	127	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:42:46	Start counter clockwise pass at 190.6 ft.	190.7	166	Video	235	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:44:11	North	190.3	339.2	Video	320	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:44:40	West	190.5	266.4	Video	349	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:45:39	South end of pass at 190.6 ft.	190.6	177.4	Video	408	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:46:33	Start clockwise pass at 189.0 ft.	189	162.9	Video	463	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:47:43	West	188.7	316.4	Video	532	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:48:09	North	188.7	47.7	Video	559	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:48:32	East	188.9	81.7	Video	581	F:\Trinity Video\Dive Four\HD\Videos\093851.mp4
10/24/2015	9:49:33	South end of pass at 189.0 ft.	189	171.5	Video	42	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:50:40	Start counter clockwise pass at 187.3 ft.	187.6	157.3	Video	109	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:52:34	North-East	187.2	32.1	Video	223	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	9:52:54	North	187.4	324.7	Video	243	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:53:30	West	187.7	219.6	Video	279	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:54:04	South end of pass at 187.3 ft.	187.7	191.9	Video	314	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:56:36	Start clockwise of pass at 186.5 ft.	186.4	145.7	Video	465	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:57:36	West	186.3	2.2	Video	525	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:57:47	North	186.1	75.6	Video	536	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:58:03	East	186.4	135.6	Video	552	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:58:26	South end of pass at 186.5 ft.	186.4	167	Video	575	F:\Trinity Video\Dive Four\HD\Videos\094851.mp4
10/24/2015	9:59:16	Start counter clockwise pass at 184.5 ft.	184.7	175.9	Video	25	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:00:01	East	184.2	68.5	Video	70	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:00:25	North	184.4	305.2	Video	94	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:00:47	West	184.7	251.5	Video	116	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:01:41	South end of pass at 184.5 ft.	184.5	187.4	Video	171	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:02:40	Start clockwise pass at 182.2 ft.	183.2	209	Video	229	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:03:59	West	182.1	308.1	Video	308	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:04:23	North	182.3	60.2	Video	332	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:04:49	East	182.4	161.5	Video	358	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	10:05:11	South end of pass at 182.2 ft.	181.8	143.4	Video	380	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:05:30	Start counter clockwise pass at 180.2 ft.	180.2	147.9	Video	399	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:06:13	East	180	66.9	Video	442	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:06:45	North	180.1	311.4	Video	474	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:07:19	West	180.3	250.7	Video	509	F:\Trinity Video\Dive Four\HD\Videos\095851.mp4
10/24/2015	10:09:09	South end of pass at 180 ft.	180.2	186.3	Video	18	F:\Trinity Video\Dive Four\HD\Videos\100851.mp4
10/24/2015	10:09:54	Start clockwise pass at 178 ft.	178.1	214.4	Video	63	F:\Trinity Video\Dive Four\HD\Videos\100851.mp4
10/24/2015	10:11:54	West	177.7	315.8	Video	183	F:\Trinity Video\Dive Four\HD\Videos\100851.mp4
10/24/2015	10:12:20	North	177.9	61.8	Video	209	F:\Trinity Video\Dive Four\HD\Videos\100851.mp4
10/24/2015	10:12:38	East	178.1	123.6	Video	227	F:\Trinity Video\Dive Four\HD\Videos\100851.mp4
10/24/2015	10:13:05	South end of pass at 178 ft.	178	167.8	Video	254	F:\Trinity Video\Dive Four\HD\Videos\100851.mp4
10/24/2015	10:13:40	Start counter clockwise at 175.5 ft.	175.4	164.7	Video	289	F:\Trinity Video\Dive Four\HD\Videos\100851.mp4
10/24/2015	10:15:16	West	175.6	281.7	Video	386	F:\Trinity Video\Dive Four\HD\Videos\100851.mp4
10/24/2015	10:20:19	Start clockwise pass at 173 ft.	173	180.9	Video	88	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:20:57	West	173	340.7	Video	126	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:21:22	North	173	91.6	Video	151	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:21:32	East	173.1	139	Video	161	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:22:17	South end of pass at 173 ft.	172.1	223	Video	206	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	10:22:54	Start counter clockwise pass at 171 ft.	171	205.3	Video	243	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:23:44	East	171	77.7	Video	293	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:24:23	North	170.9	317	Video	332	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:24:51	West	171	221.7	Video	361	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:26:14	South end of pass at 171 ft.	170.1	220.7	Video	443	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:26:37	Start clockwise pass at 167.5 ft.	167.1	221.4	Video	466	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:28:10	West	167.4	329.2	Video	559	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:28:30	North	167.4	48.3	Video	579	F:\Trinity Video\Dive Four\HD\Videos\101851.mp4
10/24/2015	10:28:55	East	167.5	161.5	Video	4	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:29:23	South end of pass at 167.5 ft.	167.7	206.9	Video	32	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:31:47	Start counter clockwise pass at 165 ft.	164.9	237.8	Video	176	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:32:55	East	164.9	30.3	Video	244	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:33:34	North	165	298.3	Video	283	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:34:10	West	164.9	189.6	Video	319	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:34:28	South end of pass at 165 ft.	163.5	167.9	Video	337	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:34:49	Start clockwise pass at 162 ft.	161.6	168.9	Video	358	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:35:45	West	161.7	267.8	Video	414	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:36:22	North	161.7	68.1	Video	451	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	10:36:42	East	161.8	114.7	Video	471	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:37:19	South end of pass at 162 ft.	162	220.7	Video	508	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:37:41	Start counter clockwise pass at 159.5 ft.	159.5	226.2	Video	530	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:38:43	East	159.2	73.4	Video	592	F:\Trinity Video\Dive Four\HD\Videos\102851.mp4
10/24/2015	10:39:13	North	159.2	326.2	Video	22	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:39:43	West	159.3	227.1	Video	53	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:40:13	South end of pass at 159.5 ft.	159.3	157.7	Video	82	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:40:39	Start clockwise pass at 157.4 ft.	157.4	185.4	Video	108	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:41:21	West	157.2	335.2	Video	150	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:42:09	North	157.2	43.8	Video	198	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:42:30	East	157.2	143.5	Video	219	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:43:02	South end of pass at 157.4 ft.	157.4	239.3	Video	251	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:43:50	Start counter clockwise pass at 154.5 ft.	154.6	234.7	Video	299	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:44:36	East	154.4	62.8	Video	345	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:45:02	North	154.6	340.6	Video	371	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:45:43	West	154.9	274.3	Video	413	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:46:25	South end of pass at 154.5 ft.	154.6	141.3	Video	454	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	10:46:54	Start clockwise pass at 152.1 ft.	152.3	167.2	Video	483	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:47:33	West	152.1	303.8	Video	522	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:48:07	North	152	32.3	Video	556	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:48:42	East	152.1	147.8	Video	591	F:\Trinity Video\Dive Four\HD\Videos\103851.mp4
10/24/2015	10:49:09	South end of pass at 152.1 ft.	152.3	201.5	Video	18	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:49:45	Start counter clockwise pass at 149.6 ft.	149.4	183.4	Video	54	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:50:48	East	149.1	35.7	Video	117	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:51:16	North	149.1	324.8	Video	146	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:51:55	West	149.4	238.3	Video	185	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:52:25	South end of pass at 149.6 ft.	149.1	170.2	Video	214	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:52:53	Start clockwise pass at 147 ft.	144.9	185.3	Video	243	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:53:40	West	147	311.6	Video	289	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:54:06	North	147	14.7	Video	315	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:54:38	East	147.1	147.7	Video	347	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:55:00	South end of pass at 147 ft.	145.8	217.4	Video	369	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:55:28	Start counter clockwise pass at 145 ft.	145	213.8	Video	397	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:56:28	East	144.8	35.3	Video	457	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:57:04	North	144.7	330.4	Video	493	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	10:57:37	West	144.8	237	Video	526	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:58:19	South end of pass 145 ft.	144.7	136.1	Video	568	F:\Trinity Video\Dive Four\HD\Videos\104851.mp4
10/24/2015	10:58:55	Start clockwise pass at 142 ft.	141.9	127.4	Video	4	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:01:01	West	141.4	285.1	Video	130	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:01:48	North	141.5	38.2	Video	178	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:02:10	East	141.8	147.6	Video	199	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:02:50	South end of pass at 142 ft.	141.9	173.5	Video	239	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:03:40	Start counter clockwise pass at 140 ft.	139.5	184	Video	290	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:04:43	East	139.4	40.4	Video	352	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:05:14	North	139.4	339.4	Video	383	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:05:48	West	139.7	248.4	Video	417	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:06:44	South end of pass at 140 ft.	139.7	215.8	Video	473	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:07:20	Start clockwise pass at 138 ft.	137.2	271	Video	509	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:07:32	West	137.3	315.5	Video	521	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:08:17	North	137.3	43.6	Video	566	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:08:39	East	137.3	136.3	Video	588	F:\Trinity Video\Dive Four\HD\Videos\105851.mp4
10/24/2015	11:09:12	South end of pass at 138 ft.	137.7	235	Video	22	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:09:44	Start counter clockwise pass at 135 ft.	135.3	113.5	Video	53	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:10:21	Small area of spalling	134.8	73.6	Video	90	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	11:10:53	North	134.9	8.3	Video	122	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:12:05	West	135.3	208.5	Video	194	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:12:36	South end of pass at 135 ft.	135.3	189.7	Video	225	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:13:14	Start clockwise pass at 133 ft.	132.8	208.5	Video	263	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:14:08	West	132.4	278.3	Video	317	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:15:10	North	132.3	91	Video	379	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:15:45	East	132.8	129.2	Video	414	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:16:19	South end of pass at 133 ft.	132.7	191.3	Video	449	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:17:11	Start counter clockwise pass at 130 ft.	130.2	168.9	Video	500	F:\Trinity Video\Dive Four\HD\Videos\110851.mp4
10/24/2015	11:19:00	North	129.9	291	Video	10	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:19:32	West	130.3	296.3	Video	41	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:20:10	South end of pass at 130 ft.	130.4	236.2	Video	79	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:20:55	Start clockwise pass at 127 ft.	127.6	195.8	Video	124	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:22:23	North	127	347.7	Video	212	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:23:39	East	127.3	148.2	Video	288	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:24:08	South end of pass at 127 ft.	124.7	220.3	Video	317	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:25:01	Start counter clockwise pass at 125 ft.	125.1	204.2	Video	370	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:26:07	East	125.1	61.6	Video	436	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:27:45	West	125.2	171.9	Video	534	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	11:28:00	South end of pass at 125 ft.	124.9	166.9	Video	549	F:\Trinity Video\Dive Four\HD\Videos\111851.mp4
10/24/2015	11:28:59	Start clockwise pass at 123 ft.	122.4	202	Video	8	F:\Trinity Video\Dive Four\HD\Videos\112851.mp4
10/24/2015	11:29:38	West	121.8	258.5	Video	47	F:\Trinity Video\Dive Four\HD\Videos\112851.mp4
10/24/2015	11:30:45	North	122.3	26.7	Video	114	F:\Trinity Video\Dive Four\HD\Videos\112851.mp4
10/24/2015	11:32:34	South end of pass at 123 ft.	122.8	264.8	Video	224	F:\Trinity Video\Dive Four\HD\Videos\112851.mp4
10/24/2015	11:33:41	Tie rod bolt hole open at 119 ft. depth and 205 degrees heading	119.6	196.1	Video	290	F:\Trinity Video\Dive Four\HD\Videos\112851.mp4
10/24/2015	11:36:04	Hole depth is less than 1 inch	120.5	259.1	Video	433	F:\Trinity Video\Dive Four\HD\Videos\112851.mp4
10/24/2015	11:36:46	Start counter clockwise pass at 121 ft.	120.5	152.1	Video	475	F:\Trinity Video\Dive Four\HD\Videos\112851.mp4
10/24/2015	11:38:43	Tie rod bolt hole	119.8	334.4	Video	593	F:\Trinity Video\Dive Four\HD\Videos\112851.mp4
10/24/2015	11:39:00	Tie rod bolt hole	119.9	295.7	Video	9	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:39:32	West	119.8	245.3	Video	41	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:39:39	Tie rod bolt hole	120.1	234.8	Video	48	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:40:59	South end of pass at 121 ft.	120.5	172	Video	128	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:41:45	Four tie rod bolt holes at 160 degrees at 118 ft.	118.6	155.9	Video	174	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:44:02	Start clockwise pass at 119 ft.	118.5	174.9	Video	312	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	11:44:51	Four more tie rod bolts at 119 ft. depth and 250 degrees heading	118.5	252	Video	360	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:45:07	One more tie rod bolt at 119 ft. depth and 250 degrees heading	118.6	265.2	Video	376	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:45:40	West	118.4	295.9	Video	409	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:47:13	North	118.2	16.8	Video	502	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:47:33	East	118.4	24.2	Video	522	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:48:49	South end of pass at 119 ft.	118.6	208	Video	598	F:\Trinity Video\Dive Four\HD\Videos\113851.mp4
10/24/2015	11:48:55	Most tie rod bolt holes open above and below joint	118.6	186.2	Video	4	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4
10/24/2015	11:51:20	Start counter clockwise pass at 116 ft.	116.1	110.6	Video	149	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4
10/24/2015	11:52:03	East	116.1	88.4	Video	192	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4
10/24/2015	11:53:44	North	115.7	358.6	Video	294	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4
10/24/2015	11:54:46	West	115.5	283.7	Video	355	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4
10/24/2015	11:55:35	South end of pass at 116 ft. with several tie rod bolt holes open	116	147.4	Video	404	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4
10/24/2015	11:56:34	Start clockwise pass at 114 ft.	114.2	218.5	Video	463	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	11:57:01	West	113.5	320.4	Video	491	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4
10/24/2015	11:58:20	North	113.6	20.3	Video	569	F:\Trinity Video\Dive Four\HD\Videos\114851.mp4
10/24/2015	11:59:10	East	113.9	111.2	Video	19	F:\Trinity Video\Dive Four\HD\Videos\115851.mp4
10/24/2015	12:00:00	South end of pass at 114 ft.	113.8	219.8	Video	69	F:\Trinity Video\Dive Four\HD\Videos\115851.mp4
10/24/2015	12:00:45	Pause inspection	114.2	331.1	Video	114	F:\Trinity Video\Dive Four\HD\Videos\115851.mp4
10/24/2015	13:18:25	Start counter clockwise pass at 112 ft.	111.7	125.1	Video	12	F:\Trinity Video\Dive Four\HD\Videos\131813.mp4
10/24/2015	13:20:05	East	111.8	71.5	Video	112	F:\Trinity Video\Dive Four\HD\Videos\131813.mp4
10/24/2015	13:22:40	North	111.4	337.7	Video	267	F:\Trinity Video\Dive Four\HD\Videos\131813.mp4
10/24/2015	13:24:19	West	111.7	242.1	Video	366	F:\Trinity Video\Dive Four\HD\Videos\131813.mp4
10/24/2015	13:24:59	South end of pass at 112 ft.	111.7	152	Video	406	F:\Trinity Video\Dive Four\HD\Videos\131813.mp4
10/24/2015	13:27:18	Start clockwise pass at 109 ft.	109.2	181.6	Video	545	F:\Trinity Video\Dive Four\HD\Videos\131813.mp4
10/24/2015	13:28:49	West	108.7	288.3	Video	36	F:\Trinity Video\Dive Four\HD\Videos\132813.mp4
10/24/2015	13:29:47	North	109.1	31.1	Video	94	F:\Trinity Video\Dive Four\HD\Videos\132813.mp4
10/24/2015	13:31:21	East	109.4	158.8	Video	188	F:\Trinity Video\Dive Four\HD\Videos\132813.mp4
10/24/2015	13:32:03	South end of pass at 109 ft. with several tie rod bolt holes	109.4	201.4	Video	230	F:\Trinity Video\Dive Four\HD\Videos\132813.mp4
10/24/2015	13:34:48	Start counter clockwise pass at 107 ft.	107.7	143.7	Video	395	F:\Trinity Video\Dive Four\HD\Videos\132813.mp4
10/24/2015	13:35:35	East	107.6	46.3	Video	442	F:\Trinity Video\Dive Four\HD\Videos\132813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	13:36:15	North	107.3	344.3	Video	482	F:\Trinity Video\Dive Four\HD\Videos\132813.mp4
10/24/2015	13:36:57	West	107.5	239.7	Video	523	F:\Trinity Video\Dive Four\HD\Videos\132813.mp4
10/24/2015	13:39:22	South end of pass at 107 ft.	107.6	188.3	Video	69	F:\Trinity Video\Dive Four\HD\Videos\133813.mp4
10/24/2015	14:09:24	Start clockwise pass at 105.5 ft.	105.5	326.3	Video	71	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:12:02	West	104.7	8.5	Video	229	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:12:14	North	105.2	24.7	Video	241	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:13:46	South end of pass at 105.5 ft.	105	217.4	Video	332	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:14:21	Start counter clockwise pass at 103.1 ft.	103.1	203.4	Video	368	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:15:31	East	102.6	41.5	Video	438	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:15:55	North	102.9	307.9	Video	462	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:16:16	West	103.1	231.3	Video	483	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:17:05	South end of pass at 103.1 ft.	102.5	171.9	Video	532	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:17:58	Start clockwise pass at 101.5 ft.	101.6	179.1	Video	585	F:\Trinity Video\Dive Four\HD\Videos\140813.mp4
10/24/2015	14:18:43	West	101.3	264.3	Video	30	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:19:25	North	101.3	65.2	Video	72	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:19:57	East	101.4	161.9	Video	103	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:20:38	South end of pass at 101.5 ft.	101.3	197.4	Video	144	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	14:21:21	Start counter clockwise pass at 99.1 ft.	99.2	200.8	Video	188	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:22:25	East	99.2	48.3	Video	252	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:23:27	North	98.9	316.5	Video	314	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:23:50	West	99.3	227.4	Video	336	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:24:36	South end of pass at 99.1 ft.	99.1	144.3	Video	383	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:25:36	Start clockwise pass at 97.1 ft.	97.1	170.9	Video	443	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:26:38	West	96.7	321.4	Video	504	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:27:10	North	96.8	22	Video	536	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:28:05	East	97.2	151.9	Video	592	F:\Trinity Video\Dive Four\HD\Videos\141813.mp4
10/24/2015	14:28:44	South end of pass at 97 ft.	97	240	Video	31	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:29:51	Start counter clockwise pass at 94.5 ft.	94.6	217.1	Video	98	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:30:56	East	94.2	25	Video	162	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:31:46	North	94.6	306.3	Video	213	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:32:31	West	94.7	216.8	Video	258	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:32:54	South end of pass at 94.6 ft.	94.4	220.9	Video	281	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:33:05	Exposed aggregate and spalling	93	226.9	Video	292	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:34:01	Start clockwise pass at 92 ft.	92.1	228.2	Video	348	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:34:26	West	91.6	263.8	Video	373	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	14:36:05	East	92.3	89.6	Video	471	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:37:08	South end of pass at 92 ft.	91.3	206.3	Video	535	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:37:38	Start counter clockwise pass at 89.2 ft.	89.2	220.1	Video	565	F:\Trinity Video\Dive Four\HD\Videos\142813.mp4
10/24/2015	14:39:44	East	88.8	69.8	Video	90	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:40:41	North	89	304.5	Video	148	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:41:45	West	89.1	227.3	Video	212	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:42:30	South end of pass at 88.3 ft.	88.3	141	Video	257	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:43:38	Embedded 8 inch air supply vent at 86.6 ft. depth and 160 degrees heading	86.5	134.6	Video	325	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:44:31	Start clockwise pass at 86.5 ft.	86.4	176.9	Video	378	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:45:16	West	86	332	Video	423	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:45:38	North	85.8	2.9	Video	445	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:47:23	East	86.6	98.4	Video	550	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:48:09	South end of pass at 86.5 ft.	86	229.9	Video	596	F:\Trinity Video\Dive Four\HD\Videos\143813.mp4
10/24/2015	14:48:39	Transition to steel	84	244.5	Video	26	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:49:11	Start counter clockwise pass at 84.1 ft.	84.1	138.5	Video	58	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:50:19	East	83.6	22.9	Video	126	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:50:45	North	83.5	5.2	Video	152	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	14:52:12	West	84.1	208.6	Video	239	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:52:39	South end of pass at 83.5 ft.	83.5	154	Video	266	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:53:35	Start clockwise pass at 81.9 ft.	82	185.9	Video	322	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:54:19	West	81.4	294.2	Video	366	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:56:17	North	81.1	18.4	Video	484	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:57:27	East	82	28.7	Video	554	F:\Trinity Video\Dive Four\HD\Videos\144813.mp4
10/24/2015	14:58:29	South end of pass at 81.8 ft.	81.8	265.8	Video	15	F:\Trinity Video\Dive Four\HD\Videos\145813.mp4
10/24/2015	15:20:59	Travel down shaft to elbow to start right springline pass	102.9	53.5	Video	166	F:\Trinity Video\Dive Four\HD\Videos\151813.mp4
10/24/2015	15:24:41	In elbow setting tether counter	213.7	180.4	Video	388	F:\Trinity Video\Dive Four\HD\Videos\151813.mp4
10/24/2015	15:25:38	Joint	214.6	191.1	Video	445	F:\Trinity Video\Dive Four\HD\Videos\151813.mp4
10/24/2015	15:30:38	Zero counter at transition from elbow to tunnel	215.6	198.3	Video	145	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4
10/24/2015	15:30:55	Traveling right springline from elbow to gate	216.3	184.3	Video	162	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4
10/24/2015	15:31:49	Joint	221.4	236.1	Video	216	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4
10/24/2015	15:33:46	Joint	223.1	223.8	Video	332	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4
10/24/2015	15:33:52	Joint	223.7	194.7	Video	339	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4
10/24/2015	15:34:00	Joint	223.7	181.2	Video	347	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	15:34:34	Joint	222.7	197.7	Video	381	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4
10/24/2015	15:34:52	Joint	224.4	175	Video	399	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4
10/24/2015	15:35:08	Joint	226.4	153.7	Video	415	F:\Trinity Video\Dive Four\HD\Videos\152813.mp4
10/24/2015	15:38:16	Joint	222.1	188.3	Video	3	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:38:43	Joint	224.3	179.3	Video	30	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:39:20	Joint	225.9	190.3	Video	67	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:40:41	Joint	226.7	180.9	Video	147	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:41:34	Joint	226.9	177.1	Video	201	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:41:57	Joint	227.1	220	Video	224	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:42:22	Joint	226.1	187.2	Video	249	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:42:30	Joint	227.6	190.4	Video	257	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:42:45	Joint	228.6	215	Video	272	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:42:52	Joint	229.7	161.7	Video	279	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:43:21	Joint	228	195.8	Video	308	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:44:57	Joint	230.2	187.2	Video	403	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:46:30	Joint	230.2	206.4	Video	497	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:47:12	Joint	229.7	155.7	Video	539	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:48:02	Joint	228.4	174.5	Video	589	F:\Trinity Video\Dive Four\HD\Videos\153813.mp4
10/24/2015	15:49:26	Joint	231.5	162.3	Video	72	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:49:54	Joint	230.9	134.3	Video	101	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	15:51:07	Joint	227.9	207.7	Video	174	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:51:51	Joint	229	166.4	Video	218	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:52:28	Joint	228	202.2	Video	255	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:52:33	Joint	227.3	196.3	Video	260	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:52:35	Joint	227.1	190.3	Video	261	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:52:43	Joint	227.2	216.8	Video	270	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:53:05	Joint	225.9	205.6	Video	292	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:53:21	Joint	224	209.3	Video	308	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:53:30	Joint	223.4	193.6	Video	317	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:53:43	Joint	223.8	209.7	Video	330	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:54:02	Joint	223.7	198.5	Video	349	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:54:35	Joint	222.6	247.6	Video	382	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:54:56	Joint	222.7	202.5	Video	403	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:56:04	Joint	229	170.8	Video	470	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:56:34	Joint	225.4	220.7	Video	501	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:57:07	Joint	226.4	198.8	Video	534	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:57:21	Joint	226.9	166.5	Video	548	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:57:32	Joint	226.3	224.6	Video	559	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:57:55	Joint	224.4	208.5	Video	581	F:\Trinity Video\Dive Four\HD\Videos\154813.mp4
10/24/2015	15:58:27	Joint	221.7	202.2	Video	14	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	15:58:53	Joint	221.6	183.3	Video	40	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	15:58:56	Joint	221.4	168.6	Video	42	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	15:59:27	Joint	221.2	168	Video	74	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	15:59:32	Joint	221.9	181.2	Video	79	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:00:01	Joint	224.6	179.4	Video	108	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:00:14	Joint	223.9	165.4	Video	121	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:01:13	Joint	225.4	163.8	Video	180	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:01:22	Joint	225	166.8	Video	189	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:01:27	Joint	225	183.5	Video	194	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:01:31	Joint	224.8	187.4	Video	198	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:01:38	Joint	224.2	191.7	Video	205	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:01:48	Joint	222.6	221.1	Video	215	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:01:54	Joint	223.3	185.4	Video	221	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:02:15	Joint	222.2	154.5	Video	242	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:02:19	Joint	222.1	192.8	Video	246	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:02:26	Joint	222.9	210.3	Video	253	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:02:37	Joint	221.6	237.9	Video	264	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:02:41	Joint	221.4	214.7	Video	268	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:02:48	Joint	223.1	213	Video	275	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:02:53	Joint	223.9	201.3	Video	280	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	16:03:05	Joint	223.1	194	Video	292	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:03:13	Joint	223.1	181.7	Video	299	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:03:29	Joint	223.8	233.5	Video	316	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:03:47	Joint	224	211.5	Video	334	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:04:02	Joint	225.2	185.8	Video	348	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:04:29	Joint	225	195.9	Video	376	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:04:41	Joint	224.7	241.2	Video	388	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:05:09	Joint	224.2	221.4	Video	416	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:05:20	Joint	225.4	185.6	Video	427	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:05:28	Joint	225.5	192.2	Video	435	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:05:51	Joint	227.2	188.5	Video	457	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:06:22	Joint	224.6	211.4	Video	489	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:06:34	Joint	224.4	223.6	Video	501	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:07:01	Joint	225.9	220	Video	528	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:07:17	Joint	227.1	219.8	Video	543	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:07:22	Joint	226.9	234.8	Video	549	F:\Trinity Video\Dive Four\HD\Videos\155813.mp4
10/24/2015	16:08:22	Joint	221.7	175.1	Video	9	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:08:37	Joint	223.7	239.8	Video	24	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:09:31	Joint	224.7	238.1	Video	78	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:09:51	Paint marking	223.5	173.4	Video	97	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/24/2015	16:10:03	Joint	223.5	221.3	Video	109	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:10:06	Joint	224.2	218	Video	113	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:10:10	Joint	225.4	205	Video	117	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:10:51	Joint	222.9	179.6	Video	158	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:11:39	Joint	220.4	240.4	Video	206	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:11:53	Joint	223	218.7	Video	220	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:12:16	Joint	221.3	180.1	Video	242	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:12:19	Joint	222.1	165.8	Video	246	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:12:57	Right side of gate	226	154.2	Video	284	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:14:49	Return to elbow along crown	218.9	350.1	Video	396	F:\Trinity Video\Dive Four\HD\Videos\160813.mp4
10/24/2015	16:21:29	Paint marking "4" on crown	218.4	161.3	Video	196	F:\Trinity Video\Dive Four\HD\Videos\161813.mp4
10/24/2015	16:23:20	Paint circle on crown	216.8	337.4	Video	306	F:\Trinity Video\Dive Four\HD\Videos\161813.mp4
10/24/2015	16:39:28	Joint	213.7	353.4	Video	74	F:\Trinity Video\Dive Four\HD\Videos\163813.mp4
10/24/2015	16:41:36	Bottom of elbow	221	159	Video	202	F:\Trinity Video\Dive Four\HD\Videos\163813.mp4
10/24/2015	17:16:18	Start second laser scan at 200 ft. depth on joint at 168 degrees	199.8	170.6	Laser	485	F:\Trinity Video\Dive Four\HD\Videos\170813.mp4
10/24/2015	18:08:47	Finish fourth laser scan at 200 ft.	205.8	276	Laser	34	F:\Trinity Video\Dive Four\HD\Videos\180813.mp4
10/24/2015	18:12:14	Bottom of elbow	224.7	39.6	Laser	241	F:\Trinity Video\Dive Four\HD\Videos\180813.mp4

10.5 Dive 5

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	7:54:41	Start dive 5	226.3	10.3	Video	153	F:\Trinity Video\Dive Five\HD\Videos\075208.mp4
10/25/2015	7:54:48	Bottom of elbow facing north to back side of elbow	226.3	9.4	Video	160	F:\Trinity Video\Dive Five\HD\Videos\075208.mp4
10/25/2015	7:57:47	Right side of elbow	220.8	282.6	Video	339	F:\Trinity Video\Dive Five\HD\Videos\075208.mp4
10/25/2015	7:59:06	Back side of elbow	213.9	20.2	Video	419	F:\Trinity Video\Dive Five\HD\Videos\075208.mp4
10/25/2015	7:59:43	Possible scrape on surface on back of elbow	211.2	22.2	Video	455	F:\Trinity Video\Dive Five\HD\Videos\075208.mp4
10/25/2015	8:02:50	Crown of tunnel to bottom of elbow looking downstream at clean location from tether	205	125.6	Video	42	F:\Trinity Video\Dive Five\HD\Videos\080208.mp4
10/25/2015	8:06:26	At seal waiting for tether	82.4	293.5	Video	258	F:\Trinity Video\Dive Five\HD\Videos\080208.mp4
10/25/2015	8:08:15	Wire line from seal at 85 ft. to 95 ft. at 45 degrees	94.6	38.6	Video	367	F:\Trinity Video\Dive Five\HD\Videos\080208.mp4
10/25/2015	8:10:59	360 of ring starting at 180 degrees clockwise	81.5	129	Video	531	F:\Trinity Video\Dive Five\HD\Videos\080208.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	8:25:44	Start laser scan heading 226 p-7.5 r 18.6	82.5	231	laser	216	F:\Trinity Video\Dive Five\HD\Videos\082208.mp4
10/25/2015	9:35:06	Starting scan C of seal plate	81.8	300.7	laser	519	F:\Trinity Video\Dive Five\HD\Videos\092626.mp4
10/25/2015	11:47:18	Movement between scan K and L	81.6	272.4	laser	7	F:\Trinity Video\Dive Five\HD\Videos\114710.mp4
10/25/2015	12:32:19	Move from N to O scan	82	252.4	laser	7	F:\Trinity Video\Dive Five\HD\Videos\123212.mp4
10/25/2015	13:07:31	Finished scans of seal for spherical valve	81.8	237.5	laser	319	F:\Trinity Video\Dive Five\HD\Videos\130212.mp4
10/25/2015	13:07:49	Follow column to surface	81.9	236.2	Video	337	F:\Trinity Video\Dive Five\HD\Videos\130212.mp4
10/25/2015	13:12:00	On surface to remove laser scanner	-4.5	109.5	laser	588	F:\Trinity Video\Dive Five\HD\Videos\130212.mp4
10/25/2015	13:38:55	Follow column 2	0.9	232.1	Video	5	F:\Trinity Video\Dive Five\HD\Videos\133850.mp4
10/25/2015	13:43:28	Column 1 is to the right and 2 is to the left	2.6	156.7	Video	278	F:\Trinity Video\Dive Five\HD\Videos\133850.mp4
10/25/2015	13:44:17	5th rack up from bottom between column 1 and 2	10.8	209.5	Video	327	F:\Trinity Video\Dive Five\HD\Videos\133850.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	13:45:06	Column 2 to 3 for 5th rack bottom to top	7.9	181.6	Video	376	F:\Trinity Video\Dive Five\HD\Videos\133850.mp4
10/25/2015	13:46:47	Column 3 to 4 for 5th rack top to bottom	1.4	113.1	Video	478	F:\Trinity Video\Dive Five\HD\Videos\133850.mp4
10/25/2015	13:49:19	Column 4 to 5 for 5th rack bottom to top	7	35.2	Video	29	F:\Trinity Video\Dive Five\HD\Videos\134850.mp4
10/25/2015	13:50:47	Close up of bars	0	353.6	Video	118	F:\Trinity Video\Dive Five\HD\Videos\134850.mp4
10/25/2015	13:51:01	Column 5 to 6 for 5th rack top to bottom	-0.7	8.5	Video	131	F:\Trinity Video\Dive Five\HD\Videos\134850.mp4
10/25/2015	13:54:02	Column 6 to 7 for 5th rack top to bottom	10.2	277.3	Video	312	F:\Trinity Video\Dive Five\HD\Videos\134850.mp4
10/25/2015	13:54:26	Stick	10.2	277.3	Video	337	F:\Trinity Video\Dive Five\HD\Videos\134850.mp4
10/25/2015	13:59:53	Stick (same as before)	9.8	290.7	Video	31	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4
10/25/2015	14:00:08	Column 7 to 8 for 5th rack bottom to top	9.3	254.2	Video	46	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4
10/25/2015	14:00:23	Fish	8.3	245.9	Video	61	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4
10/25/2015	14:02:06	Column 8 to 1 for 5th rack top to bottom	2.1	147.5	Video	164	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	14:04:01	Column 1 to 2 for 4th rack top to bottom	16	248.9	Video	279	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4
10/25/2015	14:04:54	Stick in rack at 20 ft. depth	20.1	185.3	Video	332	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4
10/25/2015	14:06:42	Column 2 to 3 for 4th rack bottom to top	26.4	103.3	Video	440	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4
10/25/2015	14:08:05	Sediment on all horizontal bars and light marine growth on vertical bars	18.8	156.8	Video	523	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4
10/25/2015	14:08:56	Column 3 to 4 for 4th rack top to bottom	16.9	90	Video	574	F:\Trinity Video\Dive Five\HD\Videos\135922.mp4
10/25/2015	14:10:16	Stick on left side at 23.9 ft.	25.2	60.1	Video	54	F:\Trinity Video\Dive Five\HD\Videos\140922.mp4
10/25/2015	14:11:29	Column 4 to 5 for 4th rack bottom to top	23.2	22.2	Video	127	F:\Trinity Video\Dive Five\HD\Videos\140922.mp4
10/25/2015	14:13:12	Column 5 to 6 for 4th rack top to bottom	17.1	8	Video	230	F:\Trinity Video\Dive Five\HD\Videos\140922.mp4
10/25/2015	14:15:52	Column 6 to 7 for the 4th rack bottom to top	26.4	316	Video	390	F:\Trinity Video\Dive Five\HD\Videos\140922.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	14:17:50	Small stick on left side of rack	16.8	259.6	Video	508	F:\Trinity Video\Dive Five\HD\Videos\140922.mp4
10/25/2015	14:18:28	Column 7 to 8 for 4th rack top to bottom	17.1	200	Video	546	F:\Trinity Video\Dive Five\HD\Videos\140922.mp4
10/25/2015	14:20:20	Column 8 to 1 for 4th rack bottom to top	26.8	219.4	Video	57	F:\Trinity Video\Dive Five\HD\Videos\141922.mp4
10/25/2015	14:22:57	Column 1 to 2 for 3rd rack top to bottom	34.4	137.7	Video	215	F:\Trinity Video\Dive Five\HD\Videos\141922.mp4
10/25/2015	14:25:11	Column 2 to 3 for 3rd rack bottom to top	44	126.7	Video	349	F:\Trinity Video\Dive Five\HD\Videos\141922.mp4
10/25/2015	14:26:30	Stick at depth 39.9	38.5	109.1	Video	428	F:\Trinity Video\Dive Five\HD\Videos\141922.mp4
10/25/2015	14:28:32	Column 3 to 4 for 3rd rack top to bottom	34.5	84.5	Video	550	F:\Trinity Video\Dive Five\HD\Videos\141922.mp4
10/25/2015	14:30:58	Column 4 to 5 for 3rd rack bottom to top	43.4	56.9	Video	96	F:\Trinity Video\Dive Five\HD\Videos\142922.mp4
10/25/2015	14:33:41	Column 5 to 6 for 3rd rack top to bottom	32.7	7	Video	259	F:\Trinity Video\Dive Five\HD\Videos\142922.mp4
10/25/2015	14:36:06	Stick at 42 ft. in middle of rack	42.1	308.9	Video	404	F:\Trinity Video\Dive Five\HD\Videos\142922.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	14:36:25	Column 6 to 7 for 3rd rack bottom to top	43.7	338	Video	423	F:\Trinity Video\Dive Five\HD\Videos\142922.mp4
10/25/2015	14:39:26	Column 7 to 8 3rd rack top to bottom	33.2	262.8	Video	4	F:\Trinity Video\Dive Five\HD\Videos\143922.mp4
10/25/2015	14:41:47	Column 8 to 1 for 3rd rack bottom to top	41.5	187.1	Video	145	F:\Trinity Video\Dive Five\HD\Videos\143922.mp4
10/25/2015	14:43:39	Column 1 to 2 for 2nd rack top to bottom	49.6	181.8	Video	257	F:\Trinity Video\Dive Five\HD\Videos\143922.mp4
10/25/2015	14:44:13	Less sediment and no growth on bars	52.6	186	Video	291	F:\Trinity Video\Dive Five\HD\Videos\143922.mp4
10/25/2015	14:46:34	Column 2 to 3 for 2nd rack bottom to top	61	126.9	Video	432	F:\Trinity Video\Dive Five\HD\Videos\143922.mp4
10/25/2015	14:48:30	Fish	50.3	48.3	Video	548	F:\Trinity Video\Dive Five\HD\Videos\143922.mp4
10/25/2015	14:48:51	Column 3 to 4 for 2nd rack top to bottom	50.1	86.6	Video	569	F:\Trinity Video\Dive Five\HD\Videos\143922.mp4
10/25/2015	14:51:25	Column 4 to 5 for 2nd rack bottom to top	60.2	43.2	Video	123	F:\Trinity Video\Dive Five\HD\Videos\144922.mp4
10/25/2015	14:57:03	Column 5 to 6 for 2nd rack bottom to top	60.9	309.8	Video	460	F:\Trinity Video\Dive Five\HD\Videos\144922.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	15:01:15	Column 6 to 7 for 2nd rack top to bottom	49.1	192.2	Video	113	F:\Trinity Video\Dive Five\HD\Videos\145922.mp4
10/25/2015	15:06:24	Column 7 to 8 for 2nd rack bottom to top	59.6	164.5	Video	422	F:\Trinity Video\Dive Five\HD\Videos\145922.mp4
10/25/2015	15:09:06	Column 8 to 1 for 2nd rack top to bottom	49.3	174.7	Video	584	F:\Trinity Video\Dive Five\HD\Videos\145922.mp4
10/25/2015	15:12:46	Column 1 to 2 for 1st rack top to bottom	63.5	115.7	Video	161	F:\Trinity Video\Dive Five\HD\Videos\151004.mp4
10/25/2015	15:17:31	Column 2 to 3 from 1st rack bottom to top	80.7	139.8	Video	446	F:\Trinity Video\Dive Five\HD\Videos\151004.mp5
10/25/2015	15:18:12	Small debris outside of rack on ledge	80.6	131.2	Video	488	F:\Trinity Video\Dive Five\HD\Videos\151004.mp4
10/25/2015	15:19:29	Stick	72.3	67.3	Video	565	F:\Trinity Video\Dive Five\HD\Videos\151004.mp4
10/25/2015	15:20:26	Stick	69.3	98.5	Video	22	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:22:13	Column 3 to 4 for 1st rack bottom to top	78.9	69.8	Video	128	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:22:30	Sticks visible outside of rack on ledge	76.6	87	Video	145	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	15:23:30	Small gap between bottom most racks	73	57.8	Video	205	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:25:00	Some periodic rust nodules	66.8	56.1	Video	295	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:25:43	Column 4 to 5 for 1st rack bottom to top	78.6	224.4	Video	339	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:26:05	Buoy and sticks visible outside of rack on ledge	78.3	312.2	Video	360	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:27:35	Gap between bottom most rack and next rack up	71.9	40.9	Video	451	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:29:12	Column 5 to 6 for 1st rack bottom to top	78.6	179.5	Video	548	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:29:31	Steel and wood debris outside of rack on ledge	77.2	192.5	Video	566	F:\Trinity Video\Dive Five\HD\Videos\152005.mp4
10/25/2015	15:30:20	Bottom most rack separated at top from rack above	69.9	234.8	Video	15	F:\Trinity Video\Dive Five\HD\Videos\153004.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	15:32:16	Column 6 to 7 for 1st rack bottom to top	78.6	259.1	Video	131	F:\Trinity Video\Dive Five\HD\Videos\153004.mp4
10/25/2015	15:32:33	Wood debris outside of rack on ledge	78.3	217.8	Video	148	F:\Trinity Video\Dive Five\HD\Videos\153004.mp4
10/25/2015	15:33:31	Wood in rack	72.7	263.5	Video	206	F:\Trinity Video\Dive Five\HD\Videos\153004.mp4
10/25/2015	15:35:03	Column 7 to 8 for 1st rack bottom to top	79	172.4	Video	298	F:\Trinity Video\Dive Five\HD\Videos\153004.mp4
10/25/2015	15:35:21	Wood debris on outside of rack on ledge	78.1	195.9	Video	316	F:\Trinity Video\Dive Five\HD\Videos\153004.mp4
10/25/2015	15:39:02	Column 8 to 1 for 1st rack bottom to top	76.6	157.2	Video	537	F:\Trinity Video\Dive Five\HD\Videos\153004.mp4
10/25/2015	15:39:24	Wood debris and barrel or pipe outside of trash rack on ledge	74.9	182.1	Video	559	F:\Trinity Video\Dive Five\HD\Videos\153004.mp4
10/25/2015	15:40:09	Gap above lowest rack	72.2	187	Video	5	F:\Trinity Video\Dive Five\HD\Videos\154005.mp4
10/25/2015	15:41:35	End inspection of internal trash racks	82.4	330.3	Video	90	F:\Trinity Video\Dive Five\HD\Videos\154005.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	15:42:40	Return to surface for transfer to outside of structure	42.7	99.1	Video	156	F:\Trinity Video\Dive Five\HD\Videos\154005.mp4
10/25/2015	16:16:31	Outside of intake structure on column 1	-2.8	325	Video	8	F:\Trinity Video\Dive Five\HD\Videos\161622.mp4
10/25/2015	16:19:44	Anchor made of concrete on ledge at 82 ft.	83.3	357.2	Video	202	F:\Trinity Video\Dive Five\HD\Videos\161622.mp4
10/25/2015	16:20:24	Anchor made of concrete on ledge at 82 ft.	95.4	317.5	Video	242	F:\Trinity Video\Dive Five\HD\Videos\161622.mp4
10/25/2015	16:20:58	Buttress right side two pop outs	100	157.4	Video	276	F:\Trinity Video\Dive Five\HD\Videos\161622.mp4
10/25/2015	16:22:48	Web at 116 ft.	116.8	348	Video	386	F:\Trinity Video\Dive Five\HD\Videos\161622.mp4
10/25/2015	16:23:32	Underside of web at 124 ft. right side of column 1	124.7	348.3	Video	430	F:\Trinity Video\Dive Five\HD\Videos\161622.mp4
10/25/2015	16:24:40	Bolts next to column 2 under web at 124 ft.	124.4	306.6	Video	498	F:\Trinity Video\Dive Five\HD\Videos\161622.mp4
10/25/2015	16:25:50	Fish	139.4	344.7	Video	568	F:\Trinity Video\Dive Five\HD\Videos\161622.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	16:27:07	Under web at 150 ft. on right side of column 1	151.1	333.6	Video	45	F:\Trinity Video\Dive Five\HD\Videos\162622.mp4
10/25/2015	16:28:54	Column 1	165.6	333.6	Video	152	F:\Trinity Video\Dive Five\HD\Videos\162622.mp4
10/25/2015	16:29:35	Under web at 175 ft. on right of column 1	176.3	317.7	Video	192	F:\Trinity Video\Dive Five\HD\Videos\162622.mp4
10/25/2015	16:32:15	Structure at 190 ft. along buttress 1 following up	186	327.2	Video	353	F:\Trinity Video\Dive Five\HD\Videos\162622.mp4
10/25/2015	16:35:30	On bottom	193.3	354.7	Video	548	F:\Trinity Video\Dive Five\HD\Videos\162622.mp4
10/25/2015	16:36:06	Travel up buttress one	184.3	344.7	Video	584	F:\Trinity Video\Dive Five\HD\Videos\162622.mp4
10/25/2015	16:38:03	Under web at 175 on right of buttress 1	175.1	316.2	Video	101	F:\Trinity Video\Dive Five\HD\Videos\163622.mp4
10/25/2015	16:39:17	Buttress 2 left side under web at 175 ft.	175.2	37	Video	175	F:\Trinity Video\Dive Five\HD\Videos\163622.mp4
10/25/2015	16:40:28	Buttress 2 left side	177.6	342.7	Video	246	F:\Trinity Video\Dive Five\HD\Videos\163622.mp4
10/25/2015	16:45:12	On bottom 20 ft. away from bottom of buttress at depth 188 ft.	182.1	354.1	Video	529	F:\Trinity Video\Dive Five\HD\Videos\163622.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	16:49:47	Buttress 2 below web at 175	173.9	356	Video	109	F:\Trinity Video\Dive Five\HD\Videos\164758.mp4
10/25/2015	16:51:29	Paint on buttress at 150 ft.	148.7	304.3	Video	211	F:\Trinity Video\Dive Five\HD\Videos\164758.mp4
10/25/2015	16:51:47	Under web at 150 ft. on right of buttress 2	148.7	289.7	Video	229	F:\Trinity Video\Dive Five\HD\Videos\164758.mp4
10/25/2015	16:53:19	Buttress 2	144.8	6.6	Video	321	F:\Trinity Video\Dive Five\HD\Videos\164758.mp4
10/25/2015	16:54:47	Bottom of web at 123 ft. right side of buttress 2	122	294.6	Video	409	F:\Trinity Video\Dive Five\HD\Videos\164758.mp4
10/25/2015	16:56:00	Buttress 2	102.4	326	Video	482	F:\Trinity Video\Dive Five\HD\Videos\164758.mp4
10/25/2015	16:56:27	Bottom of structure at 95 ft.	96.2	315.7	Video	509	F:\Trinity Video\Dive Five\HD\Videos\164758.mp4
10/25/2015	16:57:14	Buttress 3 top	98.8	320.8	Video	556	F:\Trinity Video\Dive Five\HD\Videos\164758.mp4
10/25/2015	16:58:05	Web at 118 ft. right side of buttress 3	119.6	265	Video	7	F:\Trinity Video\Dive Five\HD\Videos\165758.mp4
10/25/2015	16:59:13	Buttress 3	138.1	306.9	Video	75	F:\Trinity Video\Dive Five\HD\Videos\165758.mp4
10/25/2015	16:59:43	Web at 147 ft. right side of buttress 3	149.4	169.4	Video	105	F:\Trinity Video\Dive Five\HD\Videos\165758.mp4
10/25/2015	17:01:43	Buttress 3	159.6	272	Video	225	F:\Trinity Video\Dive Five\HD\Videos\165758.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	17:02:29	Web at 175 ft. to right of buttress 3	174.8	238.3	Video	271	F:\Trinity Video\Dive Five\HD\Videos\165758.mp4
10/25/2015	17:04:40	Buttress 4	177.9	264	Video	402	F:\Trinity Video\Dive Five\HD\Videos\165758.mp4
10/25/2015	17:04:52	Buttress	179	214.8	Video	414	F:\Trinity Video\Dive Five\HD\Videos\165758.mp4
10/25/2015	17:09:16	Below buttress 4	211.6	198.5	Video	78	F:\Trinity Video\Dive Five\HD\Videos\170758.mp4
10/25/2015	17:11:40	Hole next to corner at 199 ft.	198.2	141	Video	221	F:\Trinity Video\Dive Five\HD\Videos\170758.mp4
10/25/2015	17:14:24	Buttress 4 extends to bottom no follow to bottom of trash racks	172.2	185.2	Video	386	F:\Trinity Video\Dive Five\HD\Videos\170758.mp4
10/25/2015	17:15:41	Web at 150 ft. to right of buttress 4	148.5	197.6	Video	462	F:\Trinity Video\Dive Five\HD\Videos\170758.mp4
10/25/2015	17:16:57	Buttress 4	131.7	198.3	Video	539	F:\Trinity Video\Dive Five\HD\Videos\170758.mp4
10/25/2015	17:17:43	Web at 122 ft. to right of buttress 4	122	196.4	Video	585	F:\Trinity Video\Dive Five\HD\Videos\170758.mp4
10/25/2015	17:19:01	Buttress 4	108.5	205.8	Video	63	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4
10/25/2015	17:19:50	Top of buttress 4	96.5	182.2	Video	112	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4
10/25/2015	17:20:23	Buttress 5	100.9	217.2	Video	145	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4
10/25/2015	17:20:56	Web at 118 ft. to right of buttress 5	120.2	142	Video	178	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	17:22:36	Fish	149	159	Video	278	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4
10/25/2015	17:22:42	Web at 150 ft. to right of buttress 5	148.8	101.6	Video	284	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4
10/25/2015	17:23:47	Buttress 5	167.9	171.3	Video	349	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4
10/25/2015	17:24:15	Web at 175 ft. to right of buttress 5	175.4	126.4	Video	377	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4
10/25/2015	17:27:16	Buttress 5	186	160.3	Video	558	F:\Trinity Video\Dive Five\HD\Videos\171758.mp4
10/25/2015	17:28:29	Debris at bottom of buttress 5	162.5	172	Video	31	F:\Trinity Video\Dive Five\HD\Videos\172758.mp4
10/25/2015	17:28:41	Return to surface to inspect other side of intake	152.4	169.4	Video	43	F:\Trinity Video\Dive Five\HD\Videos\172758.mp4
10/25/2015	17:30:11	Trash rack at column 5	61.9	153	Video	132	F:\Trinity Video\Dive Five\HD\Videos\172758.mp4
10/25/2015	17:35:55	Column 8 down to buttress 8	21.1	16.2	Video	477	F:\Trinity Video\Dive Five\HD\Videos\172758.mp4
10/25/2015	17:37:00	Buttress 8 top	94.9	67.6	Video	542	F:\Trinity Video\Dive Five\HD\Videos\172758.mp4
10/25/2015	17:37:34	Underside of trash racks to right of buttress 8	105.1	358.4	Video	576	F:\Trinity Video\Dive Five\HD\Videos\172758.mp4
10/25/2015	17:38:02	Web at 118 ft. to right of buttress 8	123.4	45.6	Video	3	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	17:39:02	Buttress 8	151.5	24	Video	64	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4
10/25/2015	17:39:14	Web at 150 ft. to right of buttress 8	152.1	4.4	Video	76	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4
10/25/2015	17:40:07	Buttress 8	172.7	38.7	Video	128	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4
10/25/2015	17:40:30	Web at 175 ft. to right of buttress 8	178.5	335	Video	152	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4
10/25/2015	17:43:23	Buttress 8	192.3	10.2	Video	325	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4
10/25/2015	17:44:32	Steel conduit on bottom of buttress 8	199.2	326.6	Video	394	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4
10/25/2015	17:45:50	Steel conduit on right side of buttress 8	199.1	318.6	Video	472	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4
10/25/2015	17:46:11	Conduits enter intake tower	204.8	314.1	Video	493	F:\Trinity Video\Dive Five\HD\Videos\173758.mp4
10/25/2015	17:49:13	Web at 175 ft. on left side of buttress 8 towards buttress 7	175.5	88.6	Video	75	F:\Trinity Video\Dive Five\HD\Videos\174758.mp4
10/25/2015	17:51:03	Buttress 7	164.3	59.4	Video	185	F:\Trinity Video\Dive Five\HD\Videos\174758.mp4
10/25/2015	17:51:47	Web at 150 ft. to right of buttress 7	148.6	37.4	Video	229	F:\Trinity Video\Dive Five\HD\Videos\174758.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	17:54:54	Resume buttress 7	162.6	37	Video	416	F:\Trinity Video\Dive Five\HD\Videos\174758.mp4
10/25/2015	17:56:10	Web at 120 ft. to right of buttress 7	122	317.4	Video	492	F:\Trinity Video\Dive Five\HD\Videos\174758.mp4
10/25/2015	17:57:16	Bottom of trash racks to right of buttress 7	96.2	165.4	Video	558	F:\Trinity Video\Dive Five\HD\Videos\174758.mp4
10/25/2015	17:57:50	Buttress 7	92.6	112.5	Video	592	F:\Trinity Video\Dive Five\HD\Videos\174758.mp4
10/25/2015	17:58:25	Bottom of trash racks from buttress 7 to 6	93.4	87.3	Video	27	F:\Trinity Video\Dive Five\HD\Videos\175758.mp4
10/25/2015	17:58:49	Buttress 6	107	111.6	Video	51	F:\Trinity Video\Dive Five\HD\Videos\175758.mp4
10/25/2015	17:59:16	Stick on top of web at 120 ft.	120.5	95.6	Video	78	F:\Trinity Video\Dive Five\HD\Videos\175758.mp4
10/25/2015	17:59:23	Web at 120 ft. to right of buttress 6	120.9	110.8	Video	85	F:\Trinity Video\Dive Five\HD\Videos\175758.mp4
10/25/2015	18:00:43	Buttress 6	147.7	64.7	Video	165	F:\Trinity Video\Dive Five\HD\Videos\175758.mp4
10/25/2015	18:01:02	Web at 150 ft. to right of buttress 6	149.1	81.2	Video	184	F:\Trinity Video\Dive Five\HD\Videos\175758.mp4
10/25/2015	18:02:44	Buttress 6	163.3	104.6	Video	286	F:\Trinity Video\Dive Five\HD\Videos\175758.mp4
10/25/2015	18:03:34	Web at 175 ft. to right of buttress 6	175.5	176	Video	336	F:\Trinity Video\Dive Five\HD\Videos\175758.mp4

Date	Time	Description	Depth	Heading	Data Type	File Time	Video File Name
10/25/2015	18:09:19	Buttress 6	187.7	118.7	Video	80	F:\Trinity Video\Dive Five\HD\Videos\180758.mp4
10/25/2015	18:11:09	Buttress 6 bottom	190.7	137	Video	191	F:\Trinity Video\Dive Five\HD\Videos\180758.mp4
10/25/2015	18:11:58	Return to surface	137.4	145.9	Video	240	F:\Trinity Video\Dive Five\HD\Videos\180758.mp4
10/25/2015	18:12:55	Top of buttress 6	80.3	170.6	Video	297	F:\Trinity Video\Dive Five\HD\Videos\180758.mp4
10/25/2015	18:15:58	Tether caught on small bolt	117.1	65.4	Video	480	F:\Trinity Video\Dive Five\HD\Videos\180758.mp4

Appendix B:

Trash Rack Jacking Plan and Drawing

GENERAL NOTES

GENERAL

The scope of this work is limited to the temporary lifting of a maximum of 3 trashracks approximately 4'-0" as required for access to the existing Intake structure.

Maximum jacking force shall be 15,000 lbs on each side of the trashrack.

Clean and lubricate the existing trashrack grooves to reduce friction. Lift trashracks evenly on each end to reduce binding.

Details shown are typical, similar details apply to similar conditions. Questions of identification of applicable detail or structural member shall be brought to the Engineer for resolution before proceeding with work. All questions, discrepancies and conflicts shall be reported to the Engineer for adjustment before proceeding with work.

STRUCTURAL STEEL

Miscellaneous channels, angles, and plate shall conform to ASTM A36. Rectangular and round HSS sections shall conform to ASTM A500, Grade B. Steel pipe shall conform to ASTM A53, Type E, Grade B.

Steel not receiving fireproofing or exposed to weather shall have one coat of shop primer. Steel exposed to weather shall be hot dipped galvanized or other approved protective coating.

Details and workmanship shall be in accordance with the latest AISC Standard Specifications. Welding shall be in accordance with latest AWS Standards using E70 XX electrodes. All welds shall be verified by a Special Inspector in conformance to the California Building Code Section 1704.

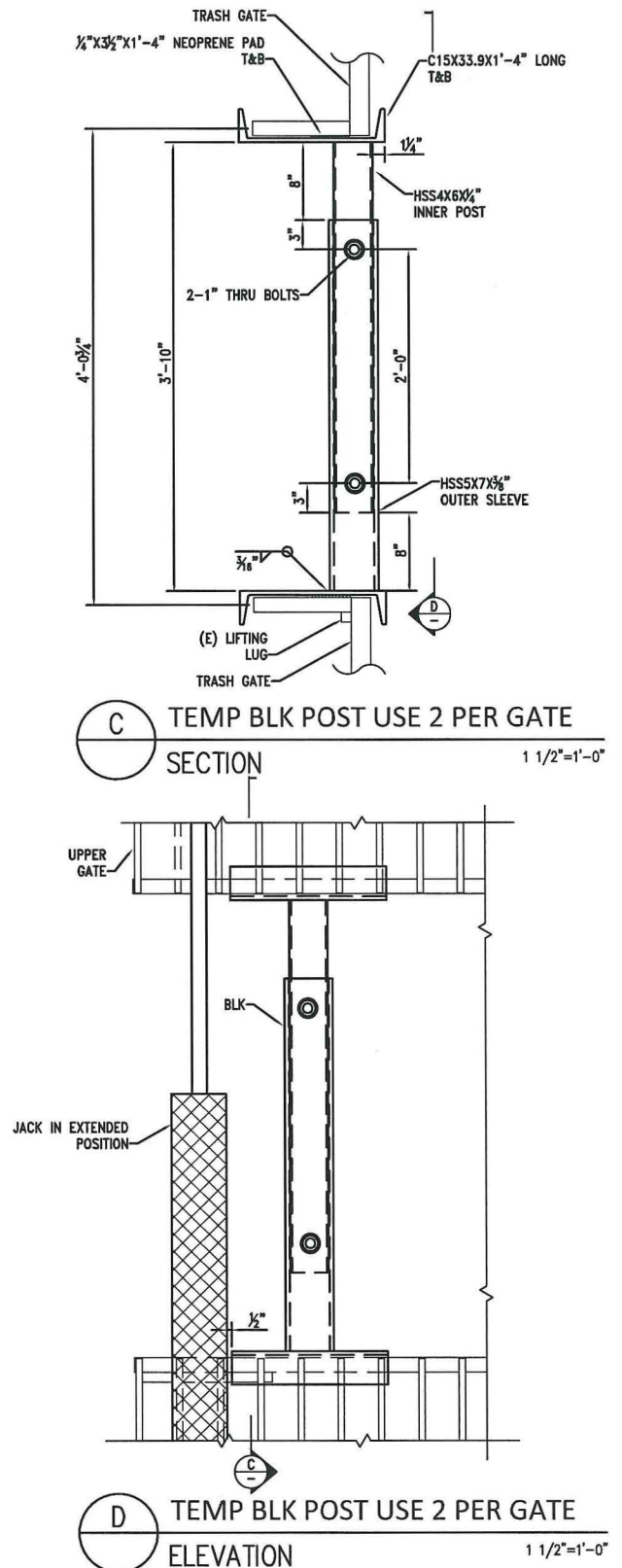
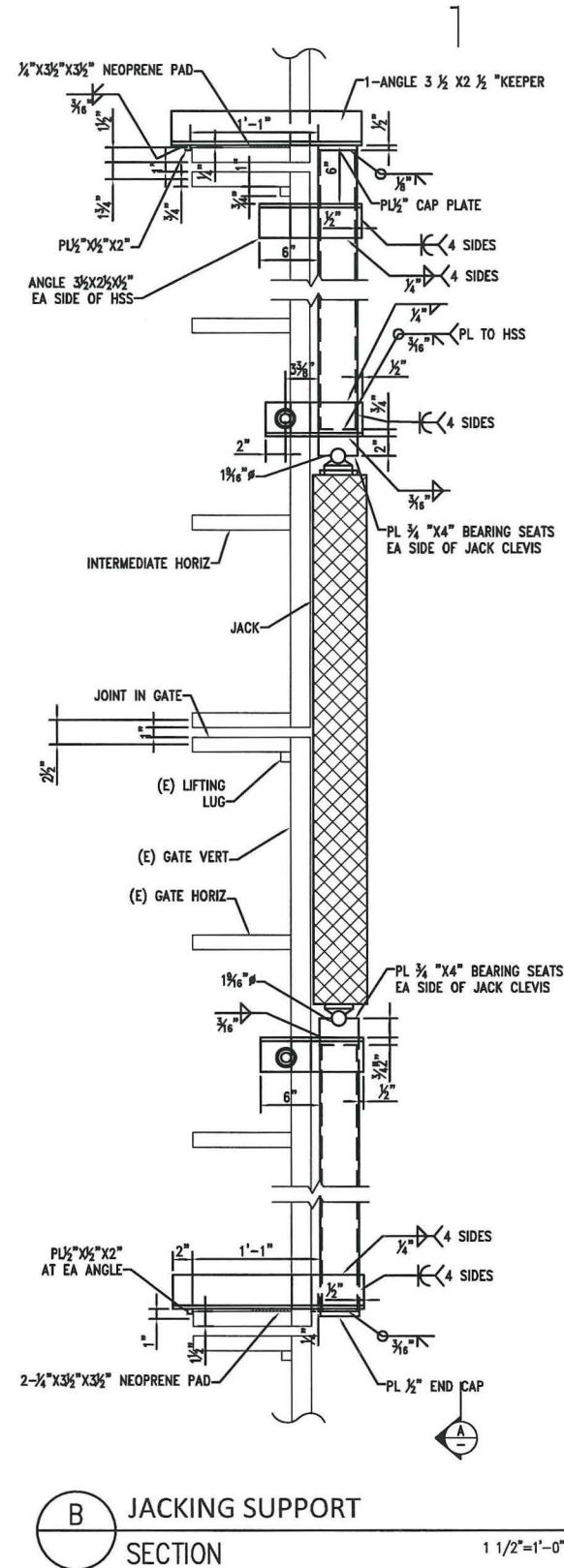
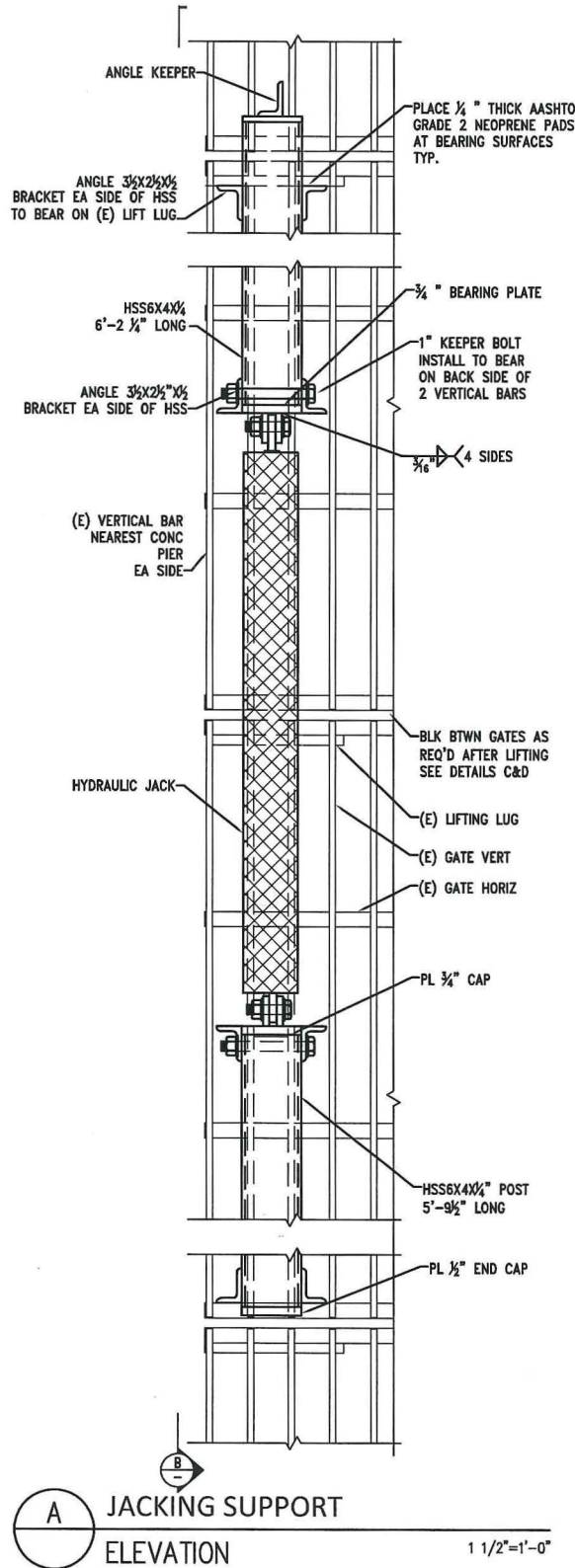
Bolts shall conform to ASTM A325, unless otherwise specified. Anchor rods shall conform to ASTM F1554 Gr. 36. Threaded rod shall conform to ASTM A36.

Lifting Sequence

- 1) Place two jacks symmetrically on the gate to be lifted. Jacks should be as close to the concrete piers on each side as practical and bearing plate should engage the existing 1" lifting lug at the top of the upper gate on each side.
- 2) Insert lower support post in trashrack, resting on neoprene pad.
- 3) Attach retaining bolt to lower support.
- 4) Hoist upper support post and insert in trashrack.
- 5) Attach retaining bolt to upper support.
- 6) Retract jack to compressed position, as shown in Section A.
- 7) Insert jack in between upper and lower supports.
- 8) Attach (bolt) ends of jack to upper and lower supports.
- 7) Advance jack to engage upper support post bearing at upper gate.
- 8) Apply uniform jacking pressure to both jacks (through Contractor supplied hydraulic manifold to avoid binding of the gates in the lifting track).
- 2) If trashracks begin to bind, cease movement, or evidence of non-uniform jacking pressures between jacks on both sides of trashrack, all lifting operations shall cease until problem is identified, resolved, and resumption of operations with uniform movement of trashrack is observed. In no case should the jacking force exceed 15,000 lbs on either jack.
- 3) When jacks have extended approximately 4 ft, Insert Temporary Block Post (Section C) in between trashracks. Block should be placed away from jack to facilitate placement, but far enough apart to facilitate insertion of ROV and related equipment, and lower onto post, with neoprene pad, top and bottom.
- 4) Once blocking is in place, jacks should be relaxed to seat the temporary support blocks. Jacks may be removed or left in place after blocking is installed.
- 5) At end of each day, attach chain link fencing section approximately 12 feet wide by 4 feet high to adjacent trashrack sections to prevent unauthorized entry through opening to Intake structure.
- 6) Re-load the jacks at the end of the operation and remove blocks. Unload jacks to lower gates, and remove support posts at the end of the project.

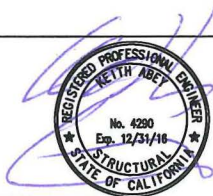
Jack Placement and Operational Notes:

- 1) Dimensions shown on drawing are based upon Prince Royal hydraulic jack Model PMC-5648, and dimensions / properties listed on cut sheet provided by Hibbard Inshore. If there is any deviation from this information, upon which the jacking system is design is based, the Engineer shall be contacted immediately.



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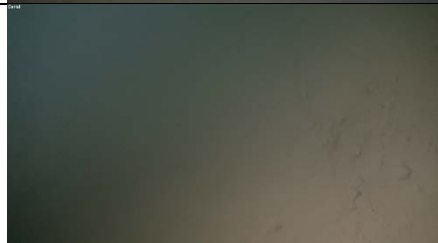
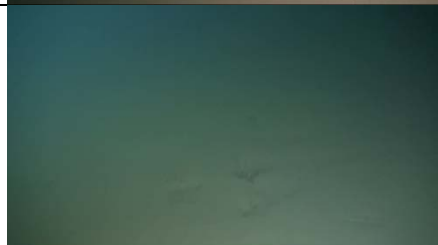
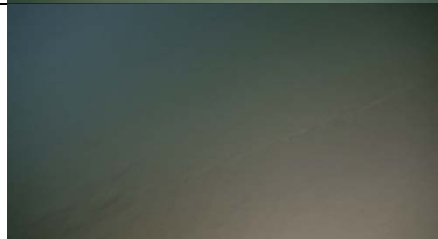
TRINITY INTAKE GATE
LIFTING JACKS





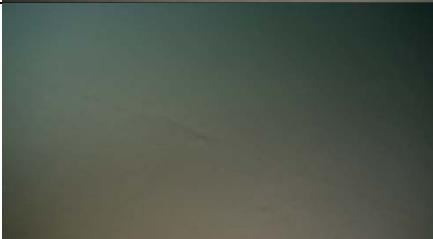
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SCALE:	1 1/2"=1'-0"
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DWG NO:	
SHT NO:	OF
REVISION	S1

Appendix C:






Trinity Video Inspection Results








Trinity Video Inspection Results

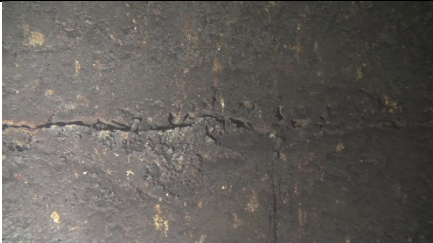



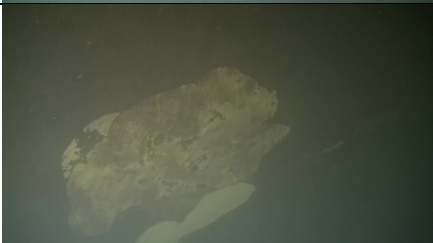
Video ID	Time Stamp	Picture	Description
Dive 1 - Dive one was performed on October 20 2016 from 20:54 to 21:29, and incorporated both a visual inspection and tests of the laser. The visual inspection was of the bulkhead seal plate area and column 3 at a depth of 82 ft. The reservoir level was 2186 ft.			
205140	3:02		Spall/bug hole
Dive 2 - Dive two was performed on October 22nd 2015 from 17:58 to 21:32. The water elevation at the start of the dive was at 2186 ft. The fixed wheel was in the open position for this dive. The ROV started at the surface and descended down the vertical shaft to the elbow. The ROV then traveled to the fixed wheel gate following the invert of the horizontal section. During this inspection the invert was covered in 1 – 2 inches of sediment obscuring the condition of the invert concrete. The gate seals and a majority of the transition to the gate were inspected including a bypass pipe.			
144728	8:58		Small bug hole
145728	6:25		Small bug hole/rock pocket
150728	0:29		Small bug holes
150728	1:34		Bug holes, joint




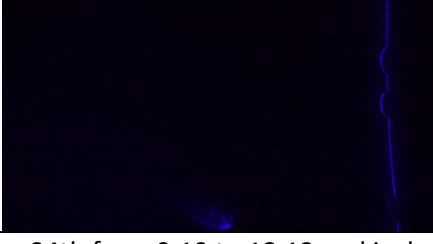


150728	1:56		Joint
150728	3:00		Joint
150728	3:34		Crack/Cold Joint
150728	6:11		Joint
150728	7:51		Silt/mud
150728	8:46		Depressions in silt/mud
151728	0:13		Joint







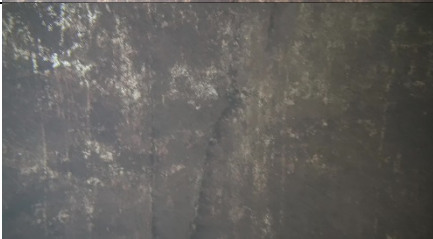
151728	7:52		Joint
151728	9:58		Joint
152728	0:58		defects
152728	4:13		Concrete/Steel
154728	9:47		Rust nodules
155728	0:21		Slime
155728	4:17		Rust nodules




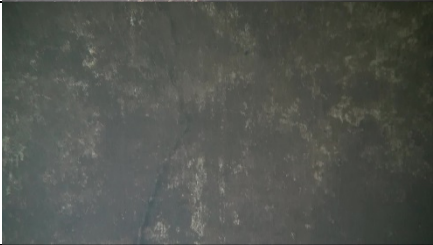

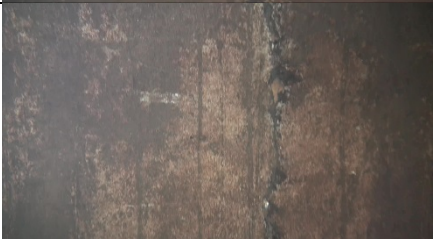
155728	6:11		Rust
160728	2:24		Slime
160728	3:45		Air vent
160728	7:25		Rock pocket
161728	3:15		Rock pocket/cavitation?
162728	6:39		Rock pockets
162728	8:15		Transition concrete to steel






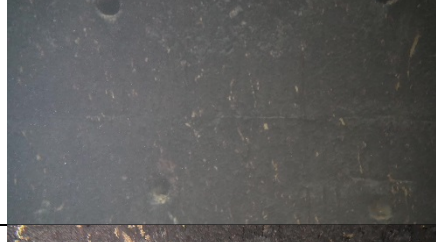

171728	5:48		Rough coating/biofilm
172728	0:38		Scrape from ROV
172728	2:24		Form work rough area
172728	9:50		Rough joint
173728	1:25		Rough joint
173728	5:59		Spall
173728	6:01		Rock pocket at joint







175728	8:10		Rock pocket at joint
181728	1:03		scrape
<p>Dive 3 - Dive three, performed on October 23rd from 13:26 to 18:29, began after Reclamation personnel lowered the fixed wheel gate for inspection. The water elevation at the start of the dive was at 2186 ft. A downline was placed in the shaft because the reinforcement embedded in the concrete and other steel features such as the trash rack interfere with the magnetic compass on the ROV making readings unreliable for navigation and orientation. The downline was placed next to column 1 and landed on the hemispherical bulkhead seal. The ROV was then used to further lower the line into the vertical section where the downline weight settled into the sediment in the elbow. The ROV was manipulated down the vertical section and into the horizontal section. The tether counter was reset to zero at the crown of the tunnel at the end of the elbow. The crown of the tunnel was inspected to the fixed wheel gate. The fixed wheel gate was visually inspected and then scanned by laser.</p>			
133551	7:40		Rope in mud at elbow
134550	8:55		Chips
135550	1:35		White area





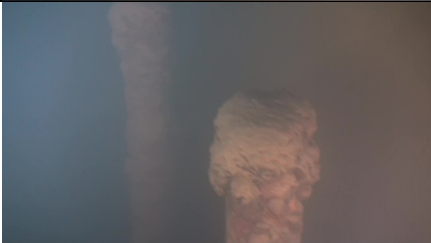

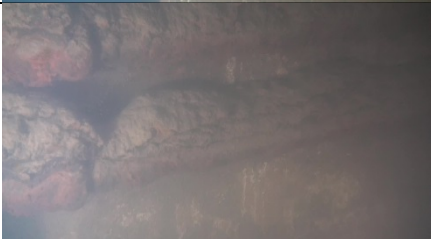
143550	7:30		Rust – near bottom of gate
143550	9:28		Rust – near top of gate
144550	3:37		Growth on gate
174058	5:52		Fish entering laser scan
<p>Dive 4 - Dive four was performed on October 24th from 9:19 to 18:12 and included a photogrammetric data collection of the vertical shaft and the inspection of the right springline and crown of the horizontal section. The water elevation at the start of this dive was at 2186 ft. The circumferential inspection of the intake shaft began at a depth of 199 feet and advanced upward. The circumferential inspections alternated rotation directions to prevent twisting the tether. The downline lowered next to column 1 was used as a visual reference point.</p>			
080201	6:26		Pipe opening
080201	8:27		Rust near gate

080201	9:27		Scrape marks from ROV?
080208	9:31		Red coating at top of gate seal
081202	6:54		Crack in joint?
081202	8:08		Close-up of surface
082202	4:44		Rough joint
082202	6:34		Smooth joint
083202	0:12		Crack near joint

083244	0:18		Crack near joint
083244	0:40		Crack
083244	1:06		Crack near joint
083244	1:24		Crack
083244	3:19		Joint spall, rock pockets? Cracking?
083244	7:25		Defect
084244	1:35		Crack/joint?

085308	4:25		Indents
090308	2:56		Joint spall near 199 ft
090308	3:13		Joint spall near 199 ft
091851	4:40		Joint spall near 199 ft
113851	2:53		Holes – depth about 123-119 ft, down
113851	3:15		Holes
113851	4:55		Close up of hole

143813	5:18		Pipe inlet near top of shaft
143813	8:20		Gate seal to concrete transition just below entry to shaft
163813	1:13		Crack/joint near elbow
165813	9:08		Transition at elbow?
Dive 5 - Dive five was performed on October 25th. The water elevation at the start of the dive was 2186 ft. It included the visual inspection of the elbow, the trash racks, and portions of exterior of the intake structure as well as laser scans of the bulkhead seal plate. A small diameter wire rope was observed hanging over the top of the vertical conduit and the bulkhead seal plate between columns 4 and 5 extending to a depth of 95 feet. The wire rope was about 4 mm (0.16 inch) in diameter			
075208	9:13		Joint
080208	9:23		Gate seal

132212	3:21		Bulkhead gate
152005	5:52		Debris at bottom of trashrack
153004	8:36		Debris at bottom of trashrack
162622	5:45		?
162622	6:39		?
170758	3:41		Hole – outside of tower
173758`	6:46		Corroded angle iron or conduit