STATE OF COLORADO

Pittinger - DNR, Rachel <rachel.pittinger@state.co.us>

OWW LLC loan

2 messages

steve.oww@wigginstel.com <steve.oww@wigginstel.com> Wed, Nov 4, 2020 at 9:24 PM
To: "Pittinger - DNR, Rachel" <rachel.pittinger@state.co.us>

I, Steve Bruntz President of the Orphan Wells of Wiggins. LLC, would like to request a change in our loan application for the Orphan Wells of Wiggins-Walker Recharge & Kiowa Reconstruction Project. The loan request for the November, 2020 CWCB meeting should include only the Kiowa Creek Dam Rehabilitation for a 30-year term in the amount of $147,000. Orphan Wells of Wiggins plans to bring the Walker Recharge Project to the January 2021, CWCB meeting and request a separate 30-year loan in the amount of $589,000.

Thank you for your consideration.

Sincerely,
Steve Bruntz, President
Orphan Wells of Wiggins, LLC

Pittinger - DNR, Rachel <rachel.pittinger@state.co.us> Thu, Nov 5, 2020 at 7:46 AM
To: steve.oww@wigginstel.com

Good morning.
Thanks for your email. I'll include it with the application paperwork.
I am working on the Board memo today. I'll send you a draft at the end of day, today.
I have 1hr to make any changes tomorrow, Friday AM. If you have changes, honestly it would be faster to talk on phone this evening after you review. I'm available to handle sensitive deadlines like these. Thank you.
Sincerely,
Rachel

Rachel Pittinger, P.E.
Project Manager
Finance Section
O 303.866.3441 x 3254 | C 720.607.3549
[Quoted text hidden]

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Water Project Loan Program

Projects financed by the Water Project Loan Program must align with the goals identified in Colorado's Water Plan and its measurable objectives.

Application Type

☐ Prequalification *(Attach 3 years of financial statements)* ☑ Loan Approval *(Attach Loan Feasibility Study)*

Agency/Company Information

Company / Borrower Name: Orphan Wells of Wiggins, LLC

Authorized Agent &Title: Steve Bruntz

Address: 3506 CR T Wiggins, CO 80654

Phone: (970) 380-1484 | Email: steve.oww@wigginstel.com

Organization Type: ☐ Ditch Co, ☐ District, ☐ Municipality ☑ other: LLC | Incorporated? ☐ YES ☑ NO

County: Morgan | Number of Shares/Taps: 225

Water District: | Avg. Water Diverted/Yr _____ acre-feet

Number of Shareholders/Customers Served: | Current Assessment per Share $ 750 (Ditch Co)

Federal ID Number: | Average monthly water bill $ _____ (Municipality)

Contact Information

Project Representative: Steve Bruntz

Phone: ( ) 9703801484 | Email: steve.oww@wigginstel.com

Engineer:

Phone: ( ) | Email:

Attorney:

Phone: ( ) | Email:

Project Information

Project Name: Orphan Wells Walker Recharge and Kiowa Reconstruction

Brief Description of Project: (Attach separate sheets if needed)

Orphan Wells will add a new recharge well near the river as an expansion of its current project to recharge water from the river to various recharge sites throughout Wiggins hill area.

Kiowa Creek Recharge sites need reconstruction for dam saftey concerns

Project Start Date(s) Design: 2/2020 Construction: 12/2020

General Location: (Attach Map of Area)

See Feasibility Study

Project Costs - Round to the nearest thousand

Estimated Engineering Costs: 0 | Estimated Construction Costs: $735,525

Other Costs (Describe Above): | Estimated Total Project Costs: $735,525

Requested Loan Amount: $735,525 | Requested Loan Term(10, 20, or 30 years): 30 Years

Signature

Steve Bruntz (President) 9/28/20

Signature / Title Date

Return to: Finance Section Attn: Matt Stearns
1313 Sherman St #718
Denver, CO 80203
Ph. 303/866.3441
e-mail: matthew.stearns@state.co.us

CWCB Loan Feasibility Study for Orphan Wells of Wiggins, LLC regarding the Walker Recharge Project and the infrastructure repairs to Kiowa Creek Recharge Facility

Report submitted to

Colorado Water Conservation Board
1313 Sherman St., Rm. 718
Denver, CO 80203

FEASIBILITY STUDY APPROVAL
Pursuant to Colorado Revised Statutes 37-60-121 &122, and in accordance with policies adopted by the Board, the CWCB staff has determined this Feasibility Study meets all applicable requirements for approval.

Signed 11/2/2020 Date

for the Kiowa Creek Recharge Facility & Dam Rehabilitation portion of this project. RP

Heath Kuntz, Principal
Adaptive Resources, Inc.
229 E. Kiowa Ave.
Fort Morgan, CO 80701
Phone: (970) 370-2481

September 24, 2020

Contents

1 Background

This feasibility study is being conducted on behalf of Orphan Wells of Wiggins, LLC in Wiggins, Colorado who is a for-profit Limited Liability Company [Wig03] providing augmentation services to the irrigation wells of its members in the surrounding area.

1.1 Purpose

The purpose of this feasibility study is to provide the basis of a new loan in the amount of $735,525 that will cover the costs of the Orphan Wells of Wiggins, LLC (OWW) construction of a new recharge well included in the Central Colorado Water Conservancy District Ground Water Management Subdistrict and Well Augmentation Subdistrict (CCWCD) Walker Recharge Project and upgrade to it's existing recharge well to be compatible. The loan will also provide funds to repair the Kiowa Creek recharge site dam facility that suffered a failure and Colorado Division of Water Resources (DWR) Dam Safety has directed its reconstruction.

The Walker recharge project is an required addition to the OWW infrastructure to allow the continued use of the member wells and increasing the augmentation capacity. OWW was founded in 2004 with the goal of providing enough augmentation supply to allow the wells to operate at full capacity each year. The Kiowa Creek recharge site has been a vital senior recharge source for OWW since 2007. The project operations support a large amount of augmentation supply to the members and its repairs are vital to ensure that OWW can augment the well depletions and projected demand from its members.

OWW has received a previous CWCB loan to fund a portion of its augmentation recharge project Decreed in Division 1 Water Court in Case No. 15CW3182 [Stab]. In addition, CCWCD has received a loan for the Walker Recharge Project which was decreed in Division 1 Water Court in Case No. 16CW3202 [Stac].

With the acquisition of the loan, OWW will be able to restore its operations of the Kiowa Creek facility in compliance with Dam Safety requirements, as well as provide additional, much needed, augmentation supplies through the decreed Walker Recharge Project to its members to increase the pumping quota from its current level of 30% [Incb].

1.2 Study Area

The study area is the OWW service area and the area close around the Walker Project Phase 1 in Well Field No. 2. This well field is located near the South Platte River and Hwy 144 and the OWW well diverts water into a recharge pipeline that discharges into recharge sites toward the Southeast of the well on Bijou Hill area. This project's general area is indicated in Figure 1. OWW portion of that project is one of the wells that is close to their existing recharge well and will be diverted into their existing pipeline to fully utilize it's capacity. None of the Walker Project underground pipe or recharge sites are part of this study.

The Kiowa Creek recharge site is located approximately 1 mile east of State Highway 39 and Morgan County Road V and is a series of recharge dams located within the creek towards the South Platte River. The Kiowa Creek Site is filled by the Bijou Irrigation Canal as indicated in Figure 1.

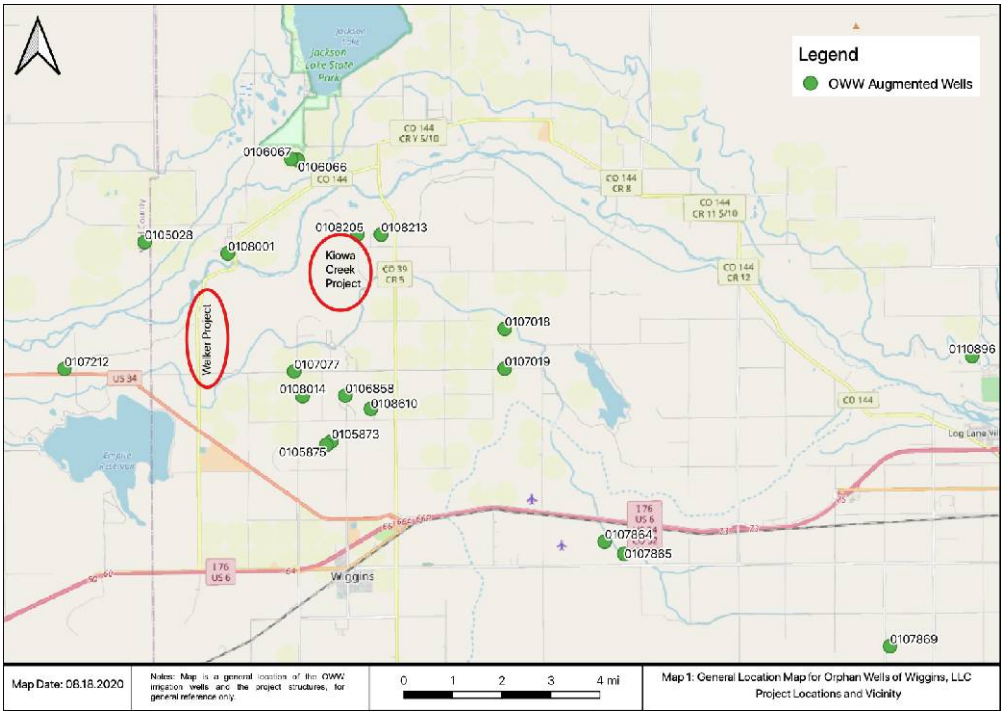


Figure 1: General Location Map

The area surrounding the Walker Recharge site is located in western Morgan County and is closest to the Town of Orchard Colorado with a population estimate of a couple hundred people and the Town of Wiggins with a population estimate of 1,163 in 2019 [Cen].

1.3 Previous Studies

There have been multiple studies that have given substantial information regarding the Walker Project including a study for the CCWCD Walker project CWCB loan [Inca] that explains in great detail the project and its full build out projection. There has also been numerous studies as part of the water court case in Case No. 16CW3202 [Stac] for the Walker Project that detailed the potential yield of the water rights, its boundaries and operating procedures and so forth.

There has been one previous feasibility study conducted for an adjacent recharge well project for OWW, submitted to CWCB dated October 2003 [Ser]. This project outlined various structure of the organization and its financial position at the time. The upgrade to the existing recharge well proposed in this plan will change the existing well within that previous study compatible with the new well that's decreed in the CCWCD Walker Recharge project.

The OWW augmentation plan Case No. 15CW3182 [Stab], includes several reports that detail maximum potential demand of the augmented water rights and their associated augmentation requirements. These estimates will be the basis for this feasibility study.

2 Project Sponsor

The project sponsor is Orphan Wells of Wiggins, LLC that is a limited liability company formed in the State of Colorado on September 22, 2003 [Wig03]. The company currently has 15 members who each own various numbers of the 225 total shares of the company that entitle them to pumping quotas, voting rights, and payments.

The company was founded in 2003 by a group of farmers in the Wiggins area. The intent was to cooperate in finding and developing new augmentation sources for their irrigation wells. At the time, the members all had been recently shut down by the changes in law and new interpretation by the Colorado Supreme Court that effected Ground Water Appropriators of the South Platte River Basin, Inc (GASP). The group started with a much larger interest pool of potential members ended up with 38 initial wells. In 2004, the company filed for an augmentation plan in Division 1 Water Court along with new water rights using the CWCB funded recharge project together with several other assets. The group was granted several Substitute Water Supply Plan (SWSP) Approvals but ended its augmentation plan case in 2008. The group reorganized and in 2015 filed for another plan for augmentation in Case No. 15CW3182 with a smaller group of members and wells with additional augmentation supplies and was granted a decree in 2018 [Stab].

OWW's primary supply of revenue is from assessments of its membership based upon their share ownership. The group has funded its existing loan repayment to CWCB along with substantial direct payments to its engineers, legal council, and infrastructure projects from its members.

OWW currently owns the OWW recharge project with a 2015 water right to pump water from the South Platte River into several decreed recharge sites through underground pipelines. This project was funded by CWCB in 2004. OWW and its members owns several recharge sites that are filled by the Bijou Irrigation Company and Riverside Irrigation District with various water right dates. In addition, OWW owns a 50% stake in the Kiowa Creek and Milliron Recharge Project decreed in 81CW382 [Staa].

3 Water Rights

There are two water rights that are effected by this loan application. The first is the Walker Recharge Project that was decreed a junior water right in Case No. 16CW3202 [Stac]. The other water right is the Kiowa Creek Recharge Site that is decreed a senior recharge water right in Case No. 81CW382 [Staa]. Both of these are decreed rights, there is no pending water court action for either project, the Walker Recharge Project is for OWW to purchase and utilize one of the wells within the Well Field No. 2. The Kiowa Creek portion of this application is for the rehabilitation of the dams and the water right has been operated since 1981.

3.1 Water Availability

The water availability is derived from the previous feasibility study for the Walker Recharge Project done by White Sands Engineering [Inca]. OWW did not recreate a study for this project, but will derive it's estimated yield as a portion of the project total within the previous report.

White Sands Engineering developed a daily point flow model (Excel spreadsheet) to evaluate water availability at the Walker Recharge Project. The model's study period

was from October 1, 1998 to December 31, 2015 for stream flow in the South Platte River from Kersey, Colorado to the Julesburg, Colorado.

The summary of results of the White Sands Engineering analysis are shown in Table 1 below. CCWCD has estimated that a maximum diversion by the Project from the South Platte River of up to 30,000 acre-feet.

> Because the Project will operate under a junior water right priority, little or no water will be available during extreme drought periods. Since all water diverted from the river will be retimed through recharge operations, long term average accretions generated by the Project should approach 14,000 af per year and provide Central with a firm supply of several thousand acre-feet. [Inca]

Table 1: CCWCD Feasibility Study Table 2 Available Flow Summary (acre-feet)

Agg	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Total**	**Vol Limited**
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max	6149	5951	6149	6149	5752	6149	3236	6149	5951	6058	5915	5951	53918	30000
Avg	1555	1466	2235	2813	2095	1476	694	1673	2362	1007	614	497	17752	14024

It's our estimate that the OWW well will produce approximately 6 cfs. The Walker Project total of 50 cfs maximum noted in section 5 of the White Sands Engineering report [Inca] or the OWW project will pump approximately 12% of the total pumping rate.

If we multiply the OWW rate proportion by the average annual volume presented in Table 1, the OWW portion of the project is projected to yield on average 1,683 acre-feet into recharge with a annual maximum of 3,600 acre-feet.

The Kiowa Creek Recharge project has been operating since 1981 at various capacities and has been expanded in 2006 with the construction of additional decreed sites. The Kiowa project is a relatively senior recharge water right on the South Platte River diverting its water through the Bijou Irrigation Canal. The Kiowa Creek Recharge project consists of 5 recharge sites that are filled through cascading from the upstream site.

The total monthly inflow summary using data from 1981 through 2020 is presented in Table 2 below.

Table 2: Kiowa Recharge Site Inflow Summary (acre-feet)

	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Total**
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
Max	1094	337	545	801	1838	1444	1705	1192	804	793	1190	1366	7620
Avg	121	19	14	51	476	546	371	450	69	108	444	531	3200

The OWW portion of the inflow results are 25% because of splits with Bijou Irrigation for delivery of the water and its 50% ownership of the project with CCWCD. The expected annual average continued diversion to recharge from this project for OWW is 800 acre-feet and a maximum annual delivery for recharge of 1,905 acre-feet.

3.2 Water Supply Demands

The OWW augmentation plan was decreed in Case No. 15CW3182 [Stab]. This case included new water rights for recharge operations, changes to well location, but one of the main purposes was to augment OWW member wells. As part of that augmentation plan, a final expert disclosure report [Inc17] was created to support the augmentation decree and estimate the total demand of the OWW augmentation plan which this feasibility study will rely upon that analysis for the determination of water supply demand.

In Section 9.1 of the expert disclosure report [Inc17], a full CU scenario was created to demonstrate the total amount of well pumping that all OWW members using their wells would generate. This was created based upon crop selection assumptions and average climate data. The total full CU annual demand of the OWW member wells in the augmentation plan was estimated at 6,296 acre-feet. In 2020, OWW was able to provide only 1780 acre-feet of pumping authorization to its membership or approximately 28% of the projected full CU demand of the members. That left a deficit of 4,516 acre-feet of augmentation credit.

4 Project Description - Analysis of Alternatives & Selected Alternative

There are two different projects OWW is undertaking. The first project is the construction of one well in Well Field 2 of the Walker Recharge Project from CCWCD and join it to the OWW existing pipeline to increase capacity as well as upgrade the existing recharge well. This includes the ability to operate the well according to the decree and water rights in Case No. 16CW3202 [Stac]. The Walker Recharge project has been decreed to divert water through recharge wells or surface diversion from the South Platte River into pipelines and pumped South from the river diversion to a series of proposed recharge sites. The project consists of the construction of a recharge well close to the South Platte River bank and the accompanying infrastructure to operate this well that will transfer the diversion to the recharge sites and then will become recharge that can be used by OWW to meet its water demands. The existing recharge well that the new well will be joined with must be upgraded to handle the influence of additional pressure and converted to electric. The upgrade will be to replace the pump and motor of the existing well to match that of the new well.

The second portion of this project is the repair and extend the outlets of Kiowa Creek ponds 1, 2, and 3 as well as the reconstruction of the Kiowa Creek Dams 4 and 5. In the spring of 2020, the recharge flow from pond 2 eroded the outlet works in pond 3 and caused a partial failure of the recharge site that cascaded down stream causing failures of dams 4 and 5. Upon inspection, DWR Dam Safety required modification to the outlets of ponds 1, 2, and 3 as well as making dams 4 and 5 approximately 20 feet in width from it's current 8 foot width as well as more rigorous compaction requirements, and armament before additional diversions could be made.

4.1 Analysis of Alternatives

The two different major sections have independent alternatives and we have analyzed each separately as OWW could choose a mix of options. The recharge well project has three alternatives including building the project, OWW building the project using its own water right, or a no action alternative.

The Kiowa Creek rehabilitation project only has one alternative and that the no-action alternative.

4.1.1 Recharge Project Alternatives

The three alternatives for this project are to build the recharge project as detailed between OWW and CCWCD to include the additional well and rebuild its existing well. The second alternative is that OWW will build a recharge project on its own without any cooperation with CCWCD. The third alternative is the no-action alternative for OWW.

OWW CCWCD Alternative

The OWW CCWCD project alternative is to construct a new well that is part of the CCWCD decree [Stac] as well as improve the existing well infrastructure and add that well to the existing OWW recharge project.

Yield - This alternative yield was estimated based upon the CCWCD Feasibility Study [Inca] information, OWW accounting for their recharge well [Incb], as well as the water court estimates within the water court reports in 16CW3202 [Stac]. The expected yield for this well should basically double the existing output of the OWW recharge operations. This assumption was made based on the fact that the OWW well decreed in 15CW3182 [Stab] is only ten months senior to the additional well that is part of this alternative. The OWW accounting for 2019 records a total of approximately 1,800 acre-feet of water diverted through existing well. The new project should enable about 3,600 acre-feet of water total for OWW to recharge during a similar year. Long-term averages from the various studies indicate that the two wells should yield 2,500 acre-feet of water that would be typical of current river conditions.

Costs - This alternative costs have been estimated as $595,665. These costs include the new construction of a well, upgrade to the existing well, and the manifold to enable each well to pump into the pipeline project. The operational costs are approximately $25 per acre-foot of water pumped that accounts for electrical pumping costs and maintenance operations. If this well pumping of 2,500 acre-feet per year and a annual payment for this portion of the project of $30132, the cost per acre-foot of water will be approximately $37.

Impacts - There are no "man-made" impacts with this alternative. The "natural" impacts of this alternative are that the project will divert water from the South Platte River when in-priority and place it into recharge to allow additional irrigation well pumping to be allowed under the existing OWW decree plan for augmentation [Stab].

Economic analysis and feasibility - This alternative fulfills a key objective of the OWW group which is to increase the pumping that can be allowed under the OWW decree for each of its members and to fully utilize the existing pipeline project built in 2004. The alternative costs will be approximately $411 per share per year for the total operations of the alternative.

Institutional Requirements - There are no institutional requirements for this project to begin operations. There will be a water court amendment required for the OWW plan for augmentation [Stab] to be able to use the additional water. This process is a minor modification and has been undertaken many times.

OWW Individual Project Alternative

The OWW individual project alternative is to construct a new well that supplements the existing well along with improvements to the existing well infrastructure and add the new well to the existing OWW recharge project, augmentation plan, and operations.

Yield - This alternative yield was estimated based upon the existing OWW plan recharge well operations during the previous years. This alternative will include the original well with a 2015 water right and a new well with a 2020 water right. The OWW accounting for 2019 records a total of approximately 1,800 acre-feet of water diverted through existing well. The new project should enable approximately 3,150 acre-feet of water total for OWW to recharge during a similar year. Long-term averages from the various studies indicate that the two wells should yield 2,188 acre-feet of water that would be typical of current river conditions. This is based on the fact that the 2020 water right would be junior to the CCWCD Walker project in the area that is projected to divert upwards of 30,000 acre-feet of water and may keep the new well out-of-priority during part of the year.

Costs - This alternative costs have been estimated as $760,000. These costs include the purchase of right-of-way and or easements through the CCWCD property, the construction of the manifold to join the new well to the existing pipeline, and the water court action for the water right and augmentation plan for the new well. The operational costs are approximately $25 per acre-foot of water pumped that accounts for electrical pumping costs and maintenance operations. If this well pumping of 2,188 acre-feet per year and a annual payment for this portion of the project of $38,488, the cost per acre-foot of water will be approximately $43.

Impacts - There are no "man-made" impacts with this alternative. The "natural" impacts of this alternative are that the project will divert water from the South Platte River when in-priority and place it into recharge to allow additional irrigation well pumping to be allowed under the existing OWW decree plan for augmentation [Stab].

Economic analysis and feasibility - This alternative also fulfills a key objective of the OWW group which is to increase the pumping that can be allowed under the OWW decree for each of its members and to fully utilize the existing pipeline project built in 2004. While this alternative does not provide as much water as the previous alternative, it does fulfill a major portion of the water required to boost allocation of the wells. The alternative costs will be approximately $418 per share per year for the total operations of the alternative.

Institutional Requirements - There are several requirements for this alternative. The first would be a major water court application for a new water right and augmentation plan of the new well. There will also be a water court amendment required for the OWW plan for augmentation [Stab] to be able to use the additional water. The new water right and augmentation plan would likely take 3 years to be fully decreed and in the mean time, substitute water supply plans could be obtained to operate during the pending water court action. The OWW water court case in 15CW3182 and the CCWCD case in 16CW3202 both required extensive studies and very contentious analysis with the CCWCD case going to trial. It would be expected that OWW would face similar opposition as it has in the past and experience what CCWCD had also undertaken.

Purchase Senior Water Supply Alternative

This alternative would be to purchase a like amount of water that is expected from the Walker Project well from water sources available. The best option for this purchase

would be shares of the Weldon Valley Ditch Company which is a senior surface water right in the same area as the Walker Project Well and the OWW well depletions at the South Platte River.

Yield- To achieve a like amount of water supply that the well is expected to yield of 1,800 acre-feet of consumable water, OWW will need to purchase 106 shares of Weldon Valley Ditch Company. The expected yield of consumable water is 17 acre-feet per share based upon previously decreed change of use analysis. The total yield of water for that amount of consumptive use is approximately 4,770 acre-feet of water that would either be required to be left in the canal, returned to the river for return flow mitigation, or placed into recharge. The purchase of this water would be much more stable then the recharge well given the senior priority date of the Weldon Valley Water Right of October 26th, 1881. The water right would also include some additional recharge credits, but would not be significant to the plan.

Costs - The alternative would be very costly. The agricultural shares that doing not have a current change of use of the canal company have ranged from $60,000 per share to $90,000 per share recently. The total estimated costs of these shares would be approximately $7,950,000 using the average of the range. In addition to this cost, there would need to be a large recharge reservoir structure constructed to accommodate the total volume of diversion within the Weldon Valley service area. The estimate would be a 300 acre recharge reservoir would be required to be constructed to enable adequate storage, infiltration, and timing for the operation of these water rights for augmentation of the wells. This site is estimated to acquire and build approximately $2,100,000. The last major cost of this alternative would be the water court change of use that would be required to be able to use the senior surface water for irrigation. The water court costs would likely be substantial given the large number of shares and volume of water being changed, it's our estimate that this change of use would require $750,000 in professional fees to complete the change of use. The total estimated costs of this alternative is $10,800,000.

Impacts - There would be significant impacts to the community for this alternative. This option is essentially a "Buy and Dry" option to transfer the water from the Weldon Valley service area to lands within the OWW service area. If the share ratio is 1 share per 10 acres within the Weldon Valley, there would be approximately 1,060 acres of land no longer irrigated within the immediate Weldon Valley service area.

Economic analysis and feasibility - This alternative fulfills the water requirement of the OWW group for it's mission to provide additional water supply to its members. This option provides a very stable and reliable source of water that would be better able to withstand droughts and administration changes on the South Platte River. However, the substantial debt burden this would apply to each share and member of OWW is not feasible. The total cost would be approximately $48,000 per share and the annual payment from CWCB for this alternative would be approximately $428,000 per year or $1,902 per share per year which would effectively double their annual budget for more then 30 years without the additional costs of operating the water rights.

Institutional Requirements - There are several major institutional requirements for this alternative. The first would be to locate that amount of shares for sale. Currently, there are few shares that would be for sale at this time and even less that would include the land required for the augmentation site. In addition, the change of use application with the water court would be required to be filed and SWSP requests would are needed to use the water. Additional requirements would be to construct a recharge facility and

get the required permits for that as well as an amendment to the existing augmentation plan to use that water as augmentation for the irrigation wells.

No-Action Recharge Project Alternative

The no-action alternative is remain as the project currently is with no modifications.

Yield - This alternative yield was estimated based upon the existing OWW plan recharge well operations during the previous years. The OWW accounting for 2019 records a total of approximately 1,800 acre-feet of water diverted through existing well. The project is expected to yield approximately 1,250 acre-feet of water each year.

Costs - There are no additional costs for this alternative. The well operations costs will be $35 per acre-foot since the existing well operates from a diesel motor with an older pump.

Impacts - There are no "man-made" or "natural" impacts with this alternative.

Economic analysis and feasibility - This alternative is already feasible for OWW as its been operating the well since 2015. The costs have fully funded for the pumping and the o & M of the project.

Institutional Requirements - There are no institutional requirements of this alternative.

4.1.2 Kiowa Creek Project Alternatives

The Kiowa Creek Rehabilitation Project Alternatives are two alternatives. The first alternative is the rehabilitation of the structure including the Dam Safety approved upgrades to each of the pond outlets and the widening of ponds 4 and 5. The second is the no-action alternative.

Kiowa Creek Rehabilitation Alternative

This alternative will be to add an extension of pipe to each of the three upper ponds in the project and armor those outlets according to the plans. This alternative will also repair the lower two ponds by replacing the sections that have eroded, and widening the dams from 8 feet to 20 feet.

Yield - This alternative yield is based on the longer term average of the project that has operated since 1981. This project's long term yield is approximately 3,200 acre-feet per year. The rehabilitation should allow this amount to be achieved into the future.

Costs - This alternative will cost OWW $147,000 to complete. The majority of the cost is for dirt work and rip-rap armor.

Impacts - There are no "man-made" or "natural" impacts with this alternative.

Economic analysis and feasibility - This alternative will cost the OWW members $7440 per year. The cost to each share would be $33 per year.

Institutional Requirements - Dam Safety has jurisdiction over the changes at this site and has already approved the plans.

No-Action Kiowa Creek Project Alternative

The no-action alternative is remain with Kiowa Creek only able to divert water into the upper pond. This would require OWW to also remove the lower ponds to allow water to flow back to the South Platte River.

Yield - This alternative yield would greatly diminish the project yield from the 3,200 acre-feet per year of total recharge to approximately 400 acre-feet per year.

Costs - Some additional cost will accrue to ensure that the lower ponds would not impede water flows during higher water times.

Impacts - There are no "man-made" or "natural" impacts with this alternative.

Economic analysis and feasibility - This alternative has no costs.

Institutional Requirements - There are no institutional requirements of this alternative.

Special considerations - This option would severely effect the OWW plan for augmentation [Stab]. The plan relys upon this site for a large portion of the recharge that is used to augment the wells as part of its plan. If this alternative would take place, the plan would be severely effected, and a majority of the pumping currently allowed would be removed.

4.2 Selected Alternative

The two selected alternatives are the OWW CCWCD Alternative and the Kiowa Creek Rehabilitation Alternative. OWW will purchase a well in the CCWCD Walker Recharge Project and upgrade its existing recharge well, and proceed to rehabilitate the Kiowa Creek Recharge site according to the proposed plans.

4.2.1 OWW Walker Recharge Project

The selected alternative is the construction of the well in the Walker Recharge Project and upgrade the existing recharge well. This is more cost effective, given that its combined with the larger CCWCD project than the other options and prevents OWW from being required to get another water right with all the associated risks.

The project consists of the construction of a new 12 inch recharge well within Well Field No. 2 of the CCWCD Walker Recharge. This will be a 200 hp electric motor powering a pump into a 12 inch discharge pipe that will cross under a small braid of the South Platte River where it will join the existing OWW 18 inch pipeline. The new well will use electrical power source and use a variable frequency drive (VFD) controller that will allow for variable diversion from the well. The existing OWW well will be upgraded also to a 200 hp electrical motor from current diesel motor with a new pump that will match the new well. The existing well will use a standard electrical controller. The conceptual drawing of the OWW Walker Project can be seen in Map 2.

There have been numerous field investigations to locate the wells, geologic studies for the entire site to ensure the suitability of the material to produce large quantities of water and engineering studies to ensure the proper size of the pipe, wells, pumps and motors as seen in Appendix 7.2.

All right-of-ways are already secured for this project and will only use existing right-of-ways already owned by OWW and the wells will be constructed on property owned by CCWCD.

4.2.2 Kiowa Creek Rehabilitation

The Kiowa Creek rehabilitation is the preferred alternative. The reduction in recharge amounts would greatly impact all the OWW members and the capacity of the plan.

Figure 2: OWW Walker Project Map

The sharp reduction in recharge would have a much larger single year effect then the total costs of rehabilitation.

The project alternative consists of the extension of each of the three outlet structures within the upper three ponds away from the dams to prevent erosion of the outlet and will require rock armor rip-rap for each of the three outlet pipes. Ponds 4 and 5 are required to add material to the dams and widen them from their current 8 foot wide configuration to a 20 foot wide configuration. The dirt is to be mined from the bottom of each pond and placed in the dam. The following Figure 3 shows the location of each pond.

The approved plans for this construction are presented in the Appendix 7.3 from June 2, 2020.

There was one field investigation done in March of 2020 that included Geotechnical Engineers to determine material suitability for the recharge site. Their report dated April 13, 2020 is included in the Appendix 7.4. No further actions are need and Dam Safety has approved the rehabilitation plans.

There are no right-of-ways required for this project as the land is owned by CCWCD and OWW where the recharge site is located.

Figure 3: Kiowa Recharge Site Map

4.3 Cost Estimate

The total costs of $735,525 for the completion of the OWW portion of the Walker Recharge project and upgrade of the existing well are detailed in Table 3 below, and the estimate was made by the CCWCD engineers, OWW staff, and ARI.

These costs estimates were made by the various contractors who are available to conduct the work. The well and related work are from a major drilling company, the manifold and pipe work is by a qualified contractor who specializes in that type of work and the electrical work was estimated by a local licensed contractor who specializes in irrigation.

The OWW cost portion of the Kiowa Creek Recharge rehabilitation project are detailed below in Table 4. These costs are estimated from the engineering specifications by the contractors who are preforming the work.

The project total has been estimated for the construction of both of these projects. The Kiowa repairs have been partially completed and the costs from Ponds 1 through 3 are better known at this time, the costs from ponds 4 and 5 repairs have yet to be completed and the variability of the required dirt work, location of suitable material and the continued change orders from the contractor are still being occurred.

Table 3: OWW Walker Project Costs

Item Description	**Cost ($)**
Well Field 2	
Well Construction	$105,000
Well 200 HP Pump & Motor	$70,000
Existing Well Upgrade 200 HP Pump & Motor	$60,000
Discharge Pipe, meter, check valve, air vent	$20,000
Elevated Platform	$15,000
Sub Total	$270,000
Manifold & Collection Pipe	
12-inch Manifold Pipe (HDPE)(380 foot bore, 400 foot trench)	$85,800
Discharge Isolation Valve with Drain	$6,000
Connection to 21-inch OWW Main Pipeline	$8,500
8 inch Air and Vacuum relief valve assembly	$12,000
Sub Total	$112,300
Electrical & Controls	
Electrical Service upgrade on CCWCD property	$12,400
2 - 225 KVA Transformers	$17,000
4" Conduit bored under slough to existing well	$28,800
2 - 200 HP VFD, Electrical Switch Gear, Distribution	$120,000
Sub Total	$178,200
Project Sub Total	$560,500
Contingency - 5%	$28,025
Total Estimated Cost	**$588,525**

Table 4: OWW Kiowa Creek Rehabilitation Costs

Item Description	**Cost ($)**
Ponds 1 - 3	
Culvert Pipe (48 inch)	$11,000
Rip-rap armor rock for outflow pipes	$22,000
Dirt Work for pipe lengthening and upgrades	$36,000
Sub Total	$69,000
Ponds 4 and 5	
Dirt Work to widen dams	$71,000
Sub Total	$71,000
Project Sub Total	$140,000
Contingency - 5%	$7,000
Total Estimated Cost	**$147,000**

4.4 Implementation Schedule

The implementation of this project has partially begun. The Kiowa Creek Rehabilitation proceeded quickly to consultation with engineers and Dam Safety in May of 2020 and a proposed design was accepted in June of 2020. In July of 2020, work commenced on Ponds 1 through 3 for the upgrade of the outlet of each pond and was finished in August of 2020. Also in August of 2020, the widening of the dams for ponds 4 and 5 began, and is projected to be completed in October of 2020.

The OWW Walker Recharge Project is projected to begin in the fall of 2020 and be finished by spring of 2021. It will commence with the construction of the additional well in the fall and collection pipe. Power lines and upgrades are scheduled to be completed by November of 2020 that will allow the wells to operate. Once that is completed, the other recharge well will be taken offline for upgrades to its pump, motor, and electrical panel. This project is expected to be completed by early spring of 2021 and would begin operations immediately.

4.5 Impacts

There are no negative impacts from the selection of each of these alternatives that would need addressed by OWW.

4.6 Institutional Feasibility

The OWW Walker Recharge project did require approvals from several governmental agencies both local, state, and federal, however, CCWCD gain all of those approvals and have begun construction of their portion of the project. No additional approvals are required for OWW's portion of the project to begin construction.

The Kiowa Creek Rehabilitation project requires Dam Safety approval of the changes to the outlets and dams. Dam Safety has given the approval for the plans and not further approvals are required.

5 Financial Feasibility Analysis

The loan feasibility of the OWW request for the two alternatives selected in Section 4.2 above is feasible and fits with the directives of the members and organization. The members voted in the 2020 annual meeting to seek both projects to enable additional pumping.

5.1 Loan Amount

The loan amount that OWW is seeking is $735,525 that accounts for both alternatives selected above. The requested term of the loan is 30 years at a 1.15% annual interest rate.

5.2 Financing Sources

The CWCB loan will be the primary financial resources for the project, OWW will supplement that funding for cost overruns or additional requirements through its own cash on-hand or through special assessments of its members on a per share basis.

5.3 Revenue and Expenditure Projections

The following table presents the annual estimated revenues and expenditures for the entire 30-year period.

Table 5: OWW Estimated Annual Revenue and Expenses During Loan Period

Revenue	
Member Assessments	$305,000
Water Sales	$12,000
Total Revenue	**$317,000**
Expenses	
Insurance	$3,500
Professional Services	$95,000
Misc	$7,500
Fuel	$5,000
Electrical Costs	$110,000
Repairs and Maintenance	$15,000
Sub Total	$236,000
Loan Payments	
Old CWCB Loan Payment	$36,961
New CWCB Loan Payment	$29,129
New Loan Reserve Payment	$2,913
Sub Total	$69,003
Total Expenses	**$305,003**
Net Operating	**$11,997**

5.4 Loan Repayment Sources

The loan repayment will be primarily member assessments. The OWW group has 225 outstanding shares owned by 15 different members of the organization. The assessments for the last three years are displayed below in Table 6.

Table 6: OWW Annual Assessments

	2017	**2018**	**2019**	**Avg**
Member Assess.	$202,348	$431,000	$255,200	$296,183
Assess / Share	$899	$1,916	$1,134	$1,316

Table 6 displays the last three years of total assessments and years previous to 2017, OWW has assessed its members for the CWCB loan payment, operations and maintenance, and other administrative tasks but was not actively operating during that time. The 2018 assessment amount was double the 2017 amount since that was the time when the organization was actively finishing its water court case in 15CW3182.

5.5 Financial Impacts

The financial impacts on the organization will increase its debt from the current existing CWCB loan with a remaining balance of $525,605 to a new total debt of $1,261,130 or increasing the debt per share from $2,336 to $5,605. OWW has no other outstanding debts.

To repay the annual loan payment plus the reserve payment during the initial 10 years, each share will owe $142, and then decrease to $129 during the 20 remaining years. The initial payment per share equals 11% of the average share assessment from 2017 through 2019. The proposed budget presented in Table 5 and total annual assessments of $305,000 or $1,356 per share is a $39 per share increase over the 2017 through 2019 average. The small increase in per share cost is mainly due to the decrease in Professional Services in their budget since their water court case is decreed and no large expenses should be incurred as long as no additional large changes are required.

Within the annual budget presented in Table 5, approximately 23% of the expected assessment of $1,356 will be used to service the CWCB total debt including the two payments and the reserve payment for the 10 year reserve payment amount.

5.6 TABOR Issues

OWW is a private limited liability company and is not subject to TABOR requirements.

5.7 Collateral

The collateral for the project will be the project itself which includes the value of the infrastructure that will be constructed from the project, the water right associated with the Walker Project for the well. In addition, the collateral will also include the Kiowa Recharge Project property owned by OWW and the 25% share of the total water right and credit owned by OWW.

5.8 Sponsor Creditworthiness

The appendix below includes the financial statements provided by OWW for the last 3 years. This includes the total revenue and expenses that were accepted at the annual meeting by the membership. The current 2020 assessment is $750 per share and will be raised to accommodate the requirement of the CWCB loan. The current bank balance is $42,688 with approximately $19,000 in outstanding assessments for 2020. In addition, during the 2019 annual meeting, the membership voted unanimously to purchase the well within the Walker Project in cooperation with CCWCD and build it while dedicating to pay for the costs.

6 Conclusions and Recommendation

The OWW organization, including a membership vote, has determined that the Walker Project well is an essential part of their augmentation project and will greatly benefit the members' ability to irrigate their farms. The augmentation feasibility studies show that the group has a large deficit remaining to achieve full irrigation and this project will greatly increase supply. This report provides a description of how funds from the CWCB would be used, the expected benefit to OWW, and the financial capacity of OWW to repay loans from CWCB.

References

[Wig03] Orphan Wells of Wiggins LLC. *Articles of Incorporation and By-Laws of Orphan Wells of Wiggins*. Sept. 22, 2003.

[Inc17] Adaptive Resources Inc. *Orphan Wells of Wiggins, LLC Rule 26(a)(2) Expert Disclosure Report Water Division 1, Case No. 15CW3182*. Oct. 30, 2017.

[Cen] Census.gov. *United States Census Population Estimates 2010 to 2019*. URL: https://www.census.gov/data/tables/time-series/demo/popest/2010s-total-cities-and-towns.html. (accessed: 08.17.2020).

[Inca] White Sands Water Engineers Inc. *CWCB Loan Feasibility Study Walker Recharge Project*. URL: https://dnrweblink.state.co.us/CWCB/ElectronicFile.aspx?docid=210580&dbid=0. (accessed: 08.18.2020).

[Incb] Adaptive Resources Inc. *Case 15CW3182 Augmentation Plan Accounting for June 2020*. URL: https://dnrweblink.state.co.us/dwr/DocView.aspx?id=3648141&openfile=true. (accessed: 08.17.2020).

[Ser] Nation Engineering Services. *Feasibility of Construction of the Orphan Wells of Wiggins (OWW) Augmentation Project*. URL: https://dnrweblink.state.co.us/CWCB/DocView.aspx?id=107545&searchid=697667bf-a814-4a46-8d6e-b630e61611ce&dbid=0. (accessed: 08.18.2020).

[Staa] Division 1 Water Court State of Colorado. *Findings and Ruling of the Referee and Decree of the Water Court in Case 81CW382*. URL: https://dnrweblink.state.co.us/dwr/DocView.aspx?id=72487. (accessed: 08.17.2020).

[Stab] Division 1 Water Court State of Colorado. *Findings of Fact, Conclusions of Law, and Decree of the Water Court in Case 15CW3182*. URL: https://dnrweblink.state.co.us/dwr/DocView.aspx?id=3290100. (accessed: 08.17.2020).

[Stac] Division 1 Water Court State of Colorado. *Findings of Fact, Conclusions of Law, and Decree of the Water Court in Case 16CW3032*. URL: https://dnrweblink.state.co.us/dwr/DocView.aspx?id=3481706&cr=1. (accessed: 08.17.2020).

7 Appendix

7.1 OWW Articles of Organization and ByLaws

ARTICLES OF ORGANIZATION
Form 400 Revised July 1, 2002
Filing fee: **$50.00**
Deliver to: Colorado Secretary of State
Business Division,
1560 Broadway, Suite 200
Denver, CO 80202-5169
This document must be typed or machine printed
Copies of filed documents may be obtained at www.sos.state.co.us

FILED
DONETTA DAVIDSON
COLORADO SECRETARY OF STATE

20031303115 C
$ 100.00
SECRETARY OF STATE
09-22-2003 12:23:32

ABOVE SPACE FOR OFFICE USE ONLY

Pursuant to § 7-80-203, Colorado Revised Statutes (C.R.S.), the individual named below causes these Articles of Organization to be delivered to the Colorado Secretary of State for filing, and states as follows:

1. The name of the limited liability company is: Orphan and Widow Wells a/k/a OWW, L.L.C.

The name of a limited liability company must contain the term "limited liability company", "ltd. liability company", "limited liability co.", or "ltd. liability co." or the abbreviation "LLC" or "L.L.C." §7-90-601(3)[(e), C.R.S.

2. *If known,* The principal place of business of the limited liability company is: 3506 County Road "T", Wiggins, Colorado 80654

3. The name, and the business address, of the registered agent for service of process on the limited liability company are: Name Steven Duane Bruntz;
Business Address *(must be a street or other physical address in Colorado)* 3506 County Road "T", Wiggins, Colorado 80654
If mail is undeliverable to this address, ALSO include a post office box address:

4. a. *If the management of the limited liability company is vested in managers, mark the box*
☑ "The management of the limited liability company is vested in managers rather than members."
The name(s) and business address(es) of the initial manager(s) is(are):
Name(s) Steven Duane Bruntz Business Address(es) 3506 County Road "T", Wiggins, Colorado 80654; Alan Axton, 3506 County Road "T", Wiggins, Colorado 80654

OR

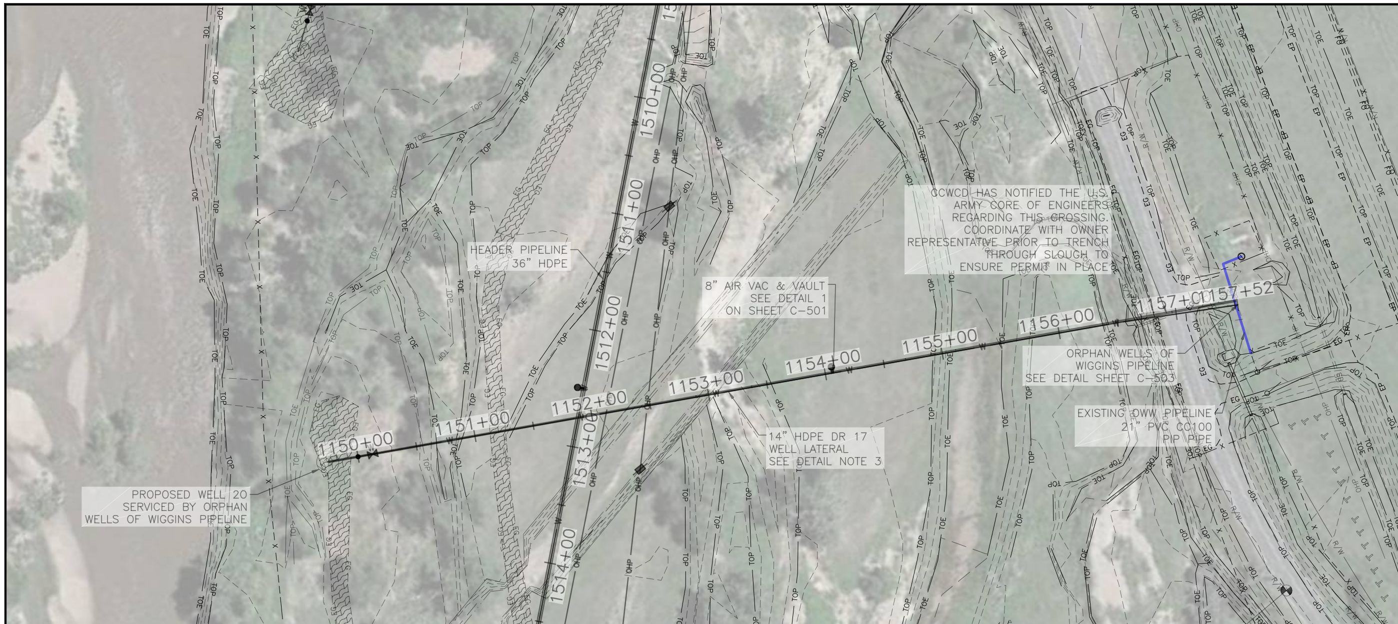
b. *If management of the limited liability company is not vested in managers rather than members,*
The name(s) and business address(es) of the initial member(s) is(are):
Name(s) Business Address(es)

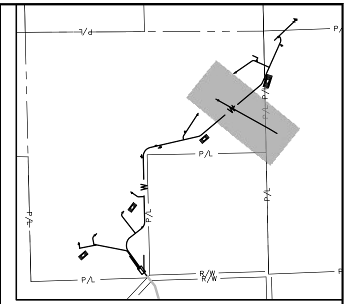
5. The (a) name or names, and (b) mailing address or addresses, of any one or more of the individuals who cause this document to be delivered for filing, and to whom the Secretary of State may deliver notice if filing of this document is refused, are: Bradley D. Laue, Esq., Brega & Winters P.C., 5754 West 11th Street, Suite #101, Greeley, Colorado 80634-4811

OPTIONAL. The electronic mail and/or Internet address for this entity is/are: e-mail
Web site
The Colorado Secretary of State may contact the following authorized person regarding this document:
name address
voice fax e-mail

Disclaimer: This form, and any related instructions, are not intended to provide legal, business or tax advice, and are offered as a public service without representation or warranty. While this form is believed to satisfy minimum legal requirements as of its revision date, compliance with applicable law, as the same may be amended from time to time, remains the responsibility of the user of this form. Questions should be addressed to the user's attorney.

7.2 OWW Walker Project Plans





KEY MAP

NOTES:

1. HDPE PIPE TO BE PE4710 DR 17 CLASS 125 HDPE OR APPROVED EQUAL
2. MAINTAIN HDPE MINIMUM BEND RADIUS OF 27X PIPE O.D. (SEE TABLE 1 BELOW)
3. MAINTAIN MINIMUM 4-FT COVER IN ALL PIPELINE LOCATIONS
4. WELL LATERALS TO BE 14" HDPE
5. HDPE FUSED FITTING TO BE SUBMITTED FOR ENGINEER APPROVAL. TAPPING SADDLES TO BE JCM, ROMAC, SPECIFIED FITTINGS, LLC OR ENGINEER APPROVED EQUAL
6. WELL LATERAL LOCATIONS APPROXIMATE, FIELD STAKE ALIGNMENT TO BE OWNER APPROVED PRIOR TO CONSTRUCTION.
7. MULTIPLE OVERHEAD POWER ALIGNMENTS SHOWN. ONLY ONE WILL BE CONSTRUCTED PER MCREA
8. CONSTRUCTION OF PIPELINE PERFORMED CONCURRENT WITH SITE OVERHEAD POWER, ELEVATED PADS, ETC. COORDINATE WITH OWNER.
9. ENTIRE PROJECT IS TO BE BUILT IN FLOOD PLAIN. FOLLOW ALL APPLICABLE REGULATIONS & BMPs

DETAILS:

1. AIR/VAC & VAULT PER DETAIL 1, SHEET C-501.
2. HDPE PIPE BACKFILL TRENCH/BEDDING, DETAIL 2, SEE SHEET C-501.
3. WELL DISCHARGE ISOLATION ASSEMBLY DETAIL, SHEET C-502. LOCATION OF VERTICAL 14-INCH HDPE PIPE STUBBED UP, AND ORIENTATION OF THE BURIED BUTTERFLY VALVE TO BE FIELD STAKED AND OWNER APPROVED PRIOR TO CONSTRUCTION AT EACH WELL.
4. ALL WELL LATERAL CONNECTIONS TO HEADER PIPELINE TO BE MADE USING FUSED HDPE FITTING OR TAPPING SLEEVE PER DETAIL 4, SHEET C-501.

TABLE 1 - MINIMUM BEND RADII

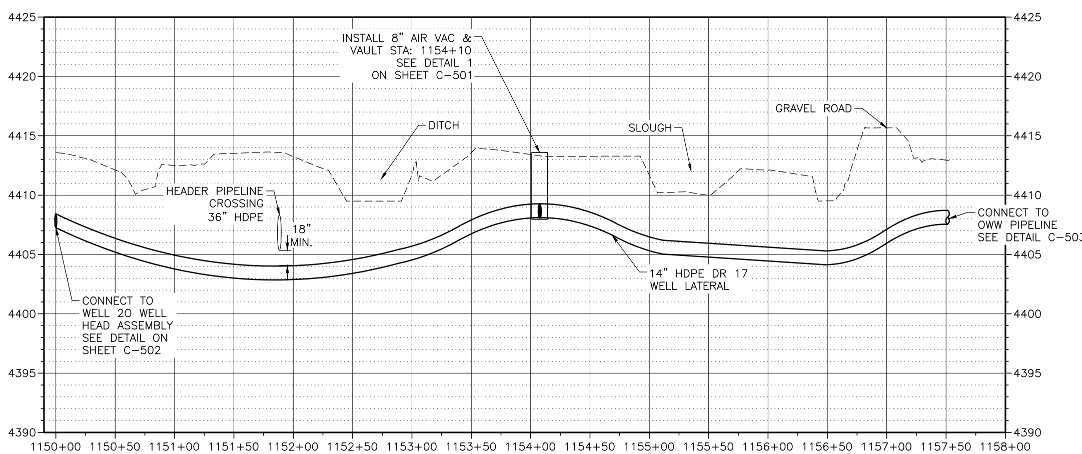
NOMINAL HDPE PIPE DIA.	MIN. RADIUS (FEET)
14"	31.5
20"	45
30"	67.5
36"	81
42"	94.5

HATCH DENOTES OWNER-BUILT GRAVEL ROAD

SYMBOL DENOTES WELL HEAD AND LETTER W2H - WELL FIELD 2 WELL "H"

~25 FT WELL HEAD ASSEMBLY AND RISER. SEE SHEET C-502

14" HDPE WELL LATERAL PIPE TO CONNECT TO BURRIED BFV AT EACH WELL DISCHARGE SEE SHEET C-502



HORZ 0 50 100
VERT 0 5 10
SCALE IN FEET

Know what's below. Call before you dig.

No.	Revisions:	Date:

WALKER RECHARGE PROJECT
CENTRAL COLORADO WATER CONSERVANCY DISTRICT

PHASE 3A WELLFIELD NO. 2 PIPELINE
OWW WELL 2O PLAN & PROFILE
STA. 96+00 TO 100+00, 1312+00 TO 1313+75

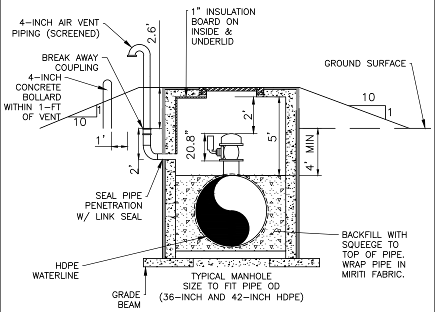
NOT FOR CONSTRUCTION
2020-05-15

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1001 (Cell)

J-U-B ENGINEERS, INC.

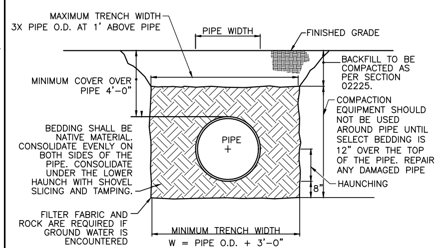
Designed By: KCY
Drawn By: KCY
Checked By: AS
Date: 5/15/2020
Sheet No.
C-106

Plot Date:5/15/2020 3:40 PM Plotted By: Andrew Stewart
Date Created:5/13/2020 \\FOFILES\PUBLIC\PROJECTS\JUB\CCWCD\87-18-016_CCWCD_WALKER_PONDS\CAD\SHEET\PHASE\87-18-016-P3_C-106.DWG


4-INCH AIR VENT PIPING (SCREENED)
1" INSULATION BOARD ON INSIDE & UNDERLID
2.6'
BREAK AWAY COUPLING
4-INCH CONCRETE BOLLARD WITHIN 1-FT OF VENT
GROUND SURFACE
10
1
10
1'
2'
20.8"
2'
5'
4' MIN
SEAL PIPE PENETRATION W/ LINK SEAL
BACKFILL WITH SQUEEGE TO TOP OF PIPE. WRAP PIPE IN MIRITI FABRIC.
HDPE WATERLINE
TYPICAL MANHOLE SIZE TO FIT PIPE OD (36-INCH AND 42-INCH HDPE)
GRADE BEAM

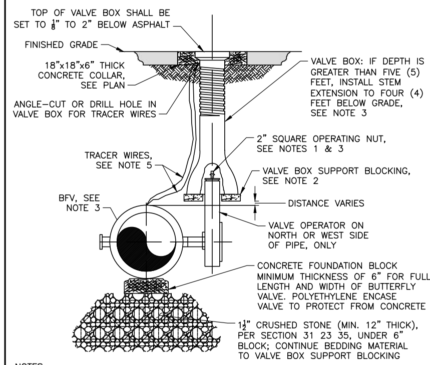
NOTES:
1. SEAL VENT PIPE PENETRATION W/ LINK-SEAL.
2. INSTALL AIR RELEASE, AIR/VACUUM, AND COMBINATION AIR VALVES IN ACCORDANCE WITH VAL-MATIC DWG# VMC-1800AVB-38 MANUFACTURER'S SPECIFICATIONS OR ENGINEER APPROVED EQUAL.
3. VAULT AND MANHOLE COVER TO BE RATED FOR HS-20 TRAFFIC LOADINGS.

1 AIR VAC & VAULT (IN LINE) DETAIL
SCALE: N.T.S.

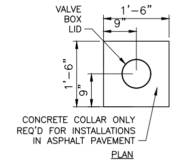

MAXIMUM TRENCH WIDTH 3X PIPE O.D. AT 1' ABOVE PIPE
PIPE WIDTH
FINISHED GRADE
BACKFILL TO BE COMPACTED AS PER SECTION 02225.
MINIMUM COVER OVER PIPE 4'-0"
COMPACTION EQUIPMENT SHOULD NOT BE USED AROUND PIPE UNTIL SELECT BEDDING IS 12" OVER THE TOP OF THE PIPE. REPAIR ANY DAMAGED PIPE
BEDDING SHALL BE NATIVE MATERIAL. CONSOLIDATE EVENLY ON BOTH SIDES OF THE PIPE. CONSOLIDATE UNDER THE LOWER HAUNCH WITH SHOVEL SLICING AND TAMPING.
PIPE
8"
HAUNCHING
FILTER FABRIC AND ROCK ARE REQUIRED IF GROUND WATER IS ENCOUNTERED
MINIMUM TRENCH WIDTH
W = PIPE O.D. + 3'-0"

NOTE: SEE AWWA M-11, AWWA C604, AND/OR SPECIFICATION SECTION 02221 TRENCHING, BACKFILLING AND COMPACTING FOR GUIDELINES.

2 TYPICAL HDPE PIPE BACKFILL TRENCH/BEDDING DETAIL (THROUGH FIELDS)
SCALE: N.T.S.

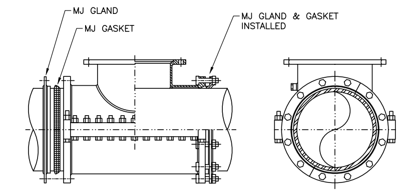

TOP OF VALVE BOX SHALL BE SET TO 1/8" TO 2" BELOW ASPHALT
FINISHED GRADE
18"x18"x6" THICK CONCRETE COLLAR, SEE PLAN
ANGLE-CUT OR DRILL HOLE IN VALVE BOX FOR TRACER WIRES
VALVE BOX: IF DEPTH IS GREATER THAN FIVE (5) FEET, INSTALL STEM EXTENSION TO FOUR (4) FEET BELOW GRADE, SEE NOTE 3
2" SQUARE OPERATING NUT, SEE NOTES 1 & 3
TRACER WIRES, SEE NOTE 5
VALVE BOX SUPPORT BLOCKING, SEE NOTE 2
BFV, SEE NOTE 3
DISTANCE VARIES
VALVE OPERATOR ON NORTH OR WEST SIDE OF PIPE, ONLY
CONCRETE FOUNDATION BLOCK MINIMUM THICKNESS OF 6" FOR FULL LENGTH AND WIDTH OF BUTTERFLY VALVE. POLYETHYLENE ENCASE VALVE TO PROTECT FROM CONCRETE
1½" CRUSHED STONE (MIN. 12" THICK), PER SECTION 31 23 35, UNDER 6" BLOCK; CONTINUE BEDDING MATERIAL TO VALVE BOX SUPPORT BLOCKING

NOTES:
1. VALVE BOX SHALL BE CENTERED AND PLUMB OVER THE OPERATING NUT AND SHALL NOT TRANSMIT SHOCK WAVES OR STRESS TO THE VALVE.
2. VALVE SHALL BE BLOCLED WITH POURED CONCRETE, BRICK, OR OTHER SUITABLE MASONRY MATERIAL.
3. BUTTERFLY VALVE AND VALVE BOX, PER SECTION 33 14 20.
4. WRAP VALVE AND VALVE BOX WITH POLYETHYLENE ENCASEMENT, PER DETAIL NO. 3305202.
5. TRACER WIRE SHALL BE TERMINATED IN VALVE BOX, AS SHOWN. REFER TO SECTION 33 14 10 FOR REQUIREMENTS.



PLAN

3 BUTTERFLY VALVE (DIRECT BURY) DETAIL
SCALE: N.T.S.

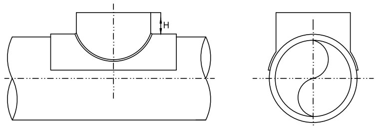


NOTE:
1. HDPE FABRICATED TEE ALLOWED IN PLACE OF TAPPING SADDLE/SLEEVE
2. JCM INDUSTRIES COMPONENTS OR ENGINEER APPROVED EQUAL
   a. DETAIL BASED ON JCM INDUSTRIES FIGURES
   b. BODY TO BE ASTM A36 OR A516 GR 70 STEEL OR EQUAL
   c. FLANGE TO BE AWWA C207 CLASS D, ANSI 150 LB
   d. CORROSION RESISTANT, HIGH STRENGTH LOW ALLOW BOLTS (AWWA C-111) OR STAINLESS STEEL.

4 TAPPING SLEEVE DETAIL
SCALE: N.T.S.

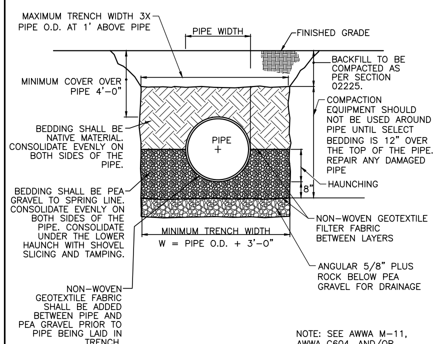
HDPE ROUND BASE BRANCH SADDLES
SIDE-FUSE X PLAIN END

BRANCE SIZE	MAINLINE RANGE	H
2"	4"-63"	4.5"
3"	6"-63"	4.5"
4"	6"-63"	5"
6"	8"-63"	5"
8"	10"-63"	7"
10"	12"-63"	7.5"
12"	16"-63"	9"
14"	18"-63"	9"



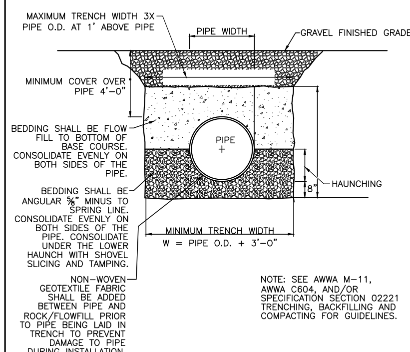
NOTE: SPECIFIED FITTINGS, LLC COMPONENETS OR ENGINEER APPROVED EQUAL DETAIL BASED ON SPECIFIED FITTINGS, LLC. COMPONENTS TO BE PE4710 DR17

5 HDPE TAPPING SADDLE
SCALE: N.T.S.


MAXIMUM TRENCH WIDTH 3X PIPE O.D. AT 1' ABOVE PIPE
PIPE WIDTH
FINISHED GRADE
BACKFILL TO BE COMPACTED AS PER SECTION 02225.
MINIMUM COVER OVER PIPE 4'-0"
COMPACTION EQUIPMENT SHOULD NOT BE USED AROUND PIPE UNTIL SELECT BEDDING IS 12" OVER THE TOP OF THE PIPE. REPAIR ANY DAMAGED PIPE
BEDDING SHALL BE NATIVE MATERIAL. CONSOLIDATE EVENLY ON BOTH SIDES OF THE PIPE.
PIPE
8"
HAUNCHING
BEDDING SHALL BE PEA GRAVEL TO SPRING LINE. CONSOLIDATE EVENLY ON BOTH SIDES OF THE PIPE. CONSOLIDATE UNDER THE LOWER HAUNCH WITH SHOVEL SLICING AND TAMPING.
NON-WOVEN GEOTEXTILE FILTER FABRIC BETWEEN LAYERS
MINIMUM TRENCH WIDTH
W = PIPE O.D. + 3'-0"
ANGULAR 5/8" PLUS ROCK BELOW PEA GRAVEL FOR DRAINAGE
NON-WOVEN GEOTEXTILE FABRIC SHALL BE ADDED BETWEEN PIPE AND PEA GRAVEL PRIOR TO PIPE BEING LAID IN TRENCH.

NOTE: SEE AWWA M-11, AWWA C604, AND/OR SPECIFICATION SECTION 02221 TRENCHING, BACKFILLING AND COMPACTING FOR GUIDELINES.

6 HDPE PIPE BACKFILL TRECH/BEDDING DETAIL IN GROUNDWATER AREAS
SCALE: N.T.S.


MAXIMUM TRENCH WIDTH 3X PIPE O.D. AT 1' ABOVE PIPE
PIPE WIDTH
GRAVEL FINISHED GRADE
MINIMUM COVER OVER PIPE 4'-0"
BEDDING SHALL BE FLOW FILL TO BOTTOM OF BASE COURSE. CONSOLIDATE EVENLY ON BOTH SIDES OF THE PIPE.
PIPE
8"
HAUNCHING
BEDDING SHALL BE ANGULAR ⅝" MINUS TO SPRING LINE. CONSOLIDATE EVENLY ON BOTH SIDES OF THE PIPE. CONSOLIDATE UNDER THE LOWER HAUNCH WITH SHOVEL SLICING AND TAMPING.
MINIMUM TRENCH WIDTH
W = PIPE O.D. + 3'-0"
NON-WOVEN GEOTEXTILE FABRIC SHALL BE ADDED BETWEEN PIPE AND ROCK/FLOWFILL PRIOR TO PIPE BEING LAID IN TRENCH TO PREVENT DAMAGE TO PIPE DURING INSTALLATION.

NOTE: SEE AWWA M-11, AWWA C604, AND/OR SPECIFICATION SECTION 02221 TRENCHING, BACKFILLING AND COMPACTING FOR GUIDELINES.

7 HDPE PIPE BACKFILL TRECH/BEDDING DETAIL UNDER GRAVEL ROADWAY
SCALE: N.T.S.

No.	Revisions:	Date:

WALKER RECHARGE PROJECT
CENTRAL COLORADO WATER CONSERVANCY DISTRICT

PHASE 3A WELLFIELD NO. 2 PIPELINE
CIVIL DETAILS

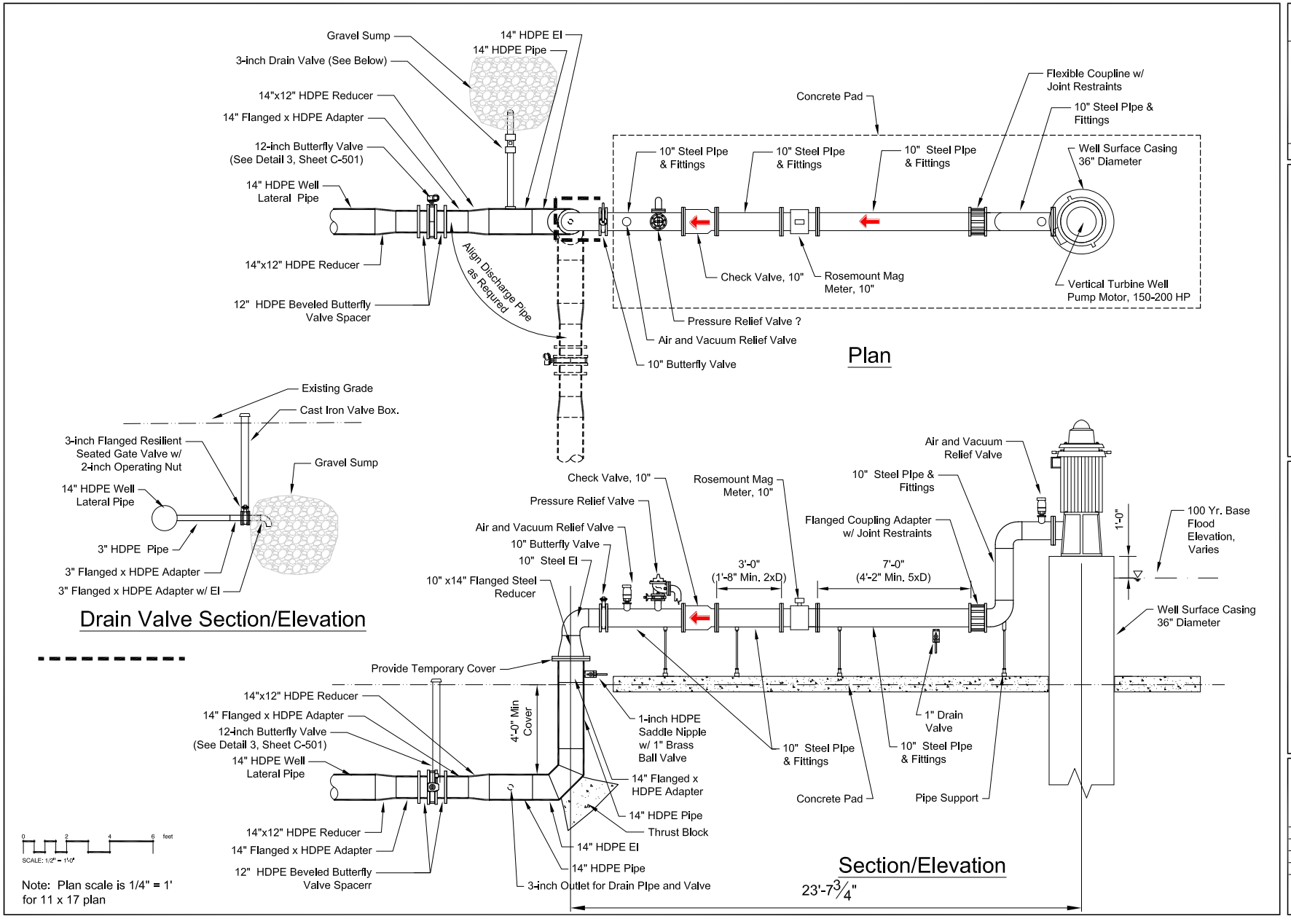
NOT FOR CONSTRUCTION
2020-05-15

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1001 (Cell)

J-U-B ENGINEERS, INC.

Designed By: KCY
Drawn By: KCY
Checked By: AS
Date: 5/15/2020
Sheet No.
C-501

Plot Date:5/15/2020 3:41 PM Plotted By: Andrew Stewart
Date Created:5/15/2020 \\FCFILES\PUBLIC\PROJECTS\JUB\CCWCD\87-18-016_CCWCD_WALKER_PONDS\CAD\SHEET\PHASE3\87-18-016-P3_C-501X.DWG



No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Walker Recharge Project
Morgan County Colorado

Well Field 2 – Typical Well Pump Discharge Assembly

Wayne E. Eckas, P.E.
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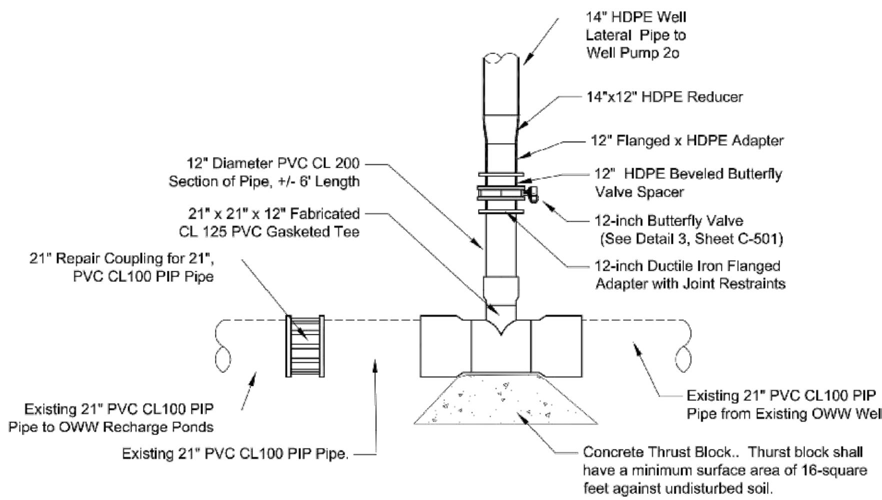
Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	5–15–2020
Sheet No.	C–502

WELL FIELD 2 - CONNECTION TO EXISTING OWW PIPELINE



14" HDPE Well Lateral Pipe to Well Pump 2o
14"x12" HDPE Reducer
12" Flanged x HDPE Adapter
12" HDPE Beveled Butterfly Valve Spacer
12-inch Butterfly Valve (See Detail 3, Sheet C-501)
12-inch Ductile Iron Flanged Adapter with Joint Restraints
12" Diameter PVC CL 200 Section of Pipe, +/- 6' Length
21" x 21" x 12" Fabricated CL 125 PVC Gasketed Tee
21" Repair Coupling for 21", PVC CL100 PIP Pipe
Existing 21" PVC CL100 PIP Pipe to OWW Recharge Ponds
Existing 21" PVC CL100 PIP Pipe.
Existing 21" PVC CL100 PIP Pipe from Existing OWW Well
Concrete Thrust Block.. Thurst block shall have a minimum surface area of 16-square feet against undisturbed soil.

Note: Plan scale is 1/4" = 1' for 11 x 17 plan

No.	Revisions:	Date:

WALKER RECHARGE PROJECT
CENTRAL COLORADO WATER CONSERVANCY DISTRICT

PHASE 3A WELLFIELD NO. 2 PIPELINE
OWW CONNECTION DETAIL

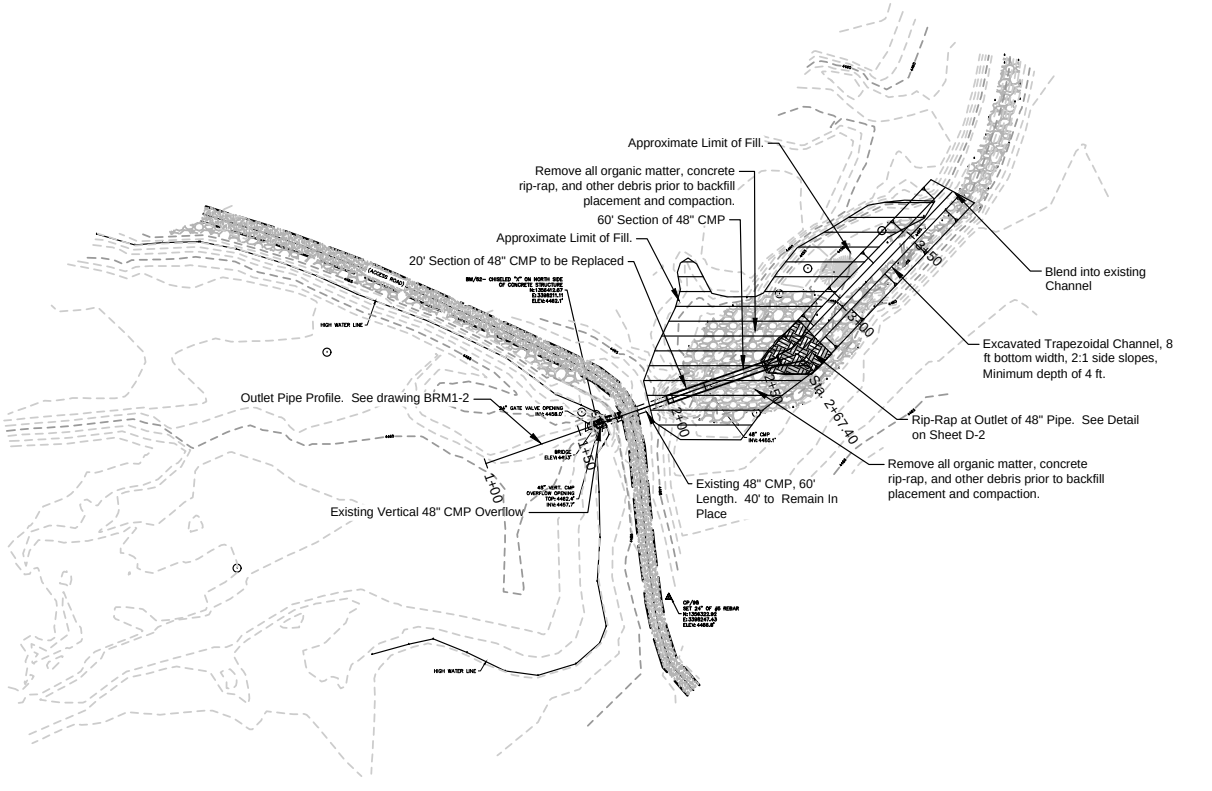
NOT FOR CONSTRUCTION
2020-05-15

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1001 (Cell)

Designed By: WEE
Drawn By: WEE
Checked By: WEE
Date: 5-13-2020
Sheet No.
C-503

Plot Date:5/15/2020 3:41 PM Plotted By: Andrew Stewart
Date Created:5/15/2020 \\FCFILES\PUBLIC\PROJECTS\JUB\COWCD\87-18-016_COWCD_WALKER_PONDS\CAD\SHEET\PHASE3\87-18-016-P3_C-501X.DWG

7.3 OWW Kiowa Plans



NORTH

0 60 120 180 feet

SCALE: 1" = 60' (11x17)

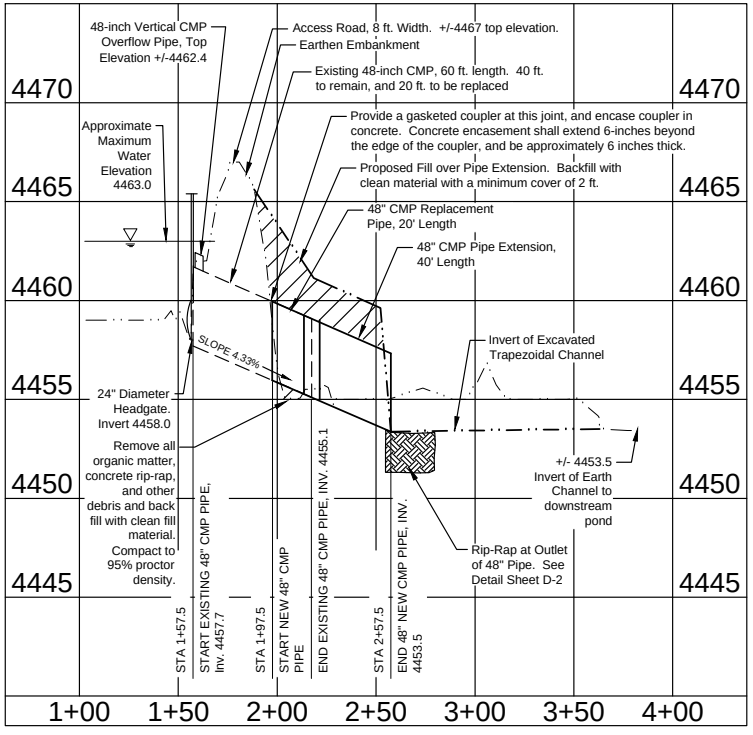
No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Berm 1 – Outlet Pipe Repair Plan

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1601 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	2-28-2020
Sheet No.	BRM1-1



1 Berm 1 - Outlet Pipeline Profile

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'

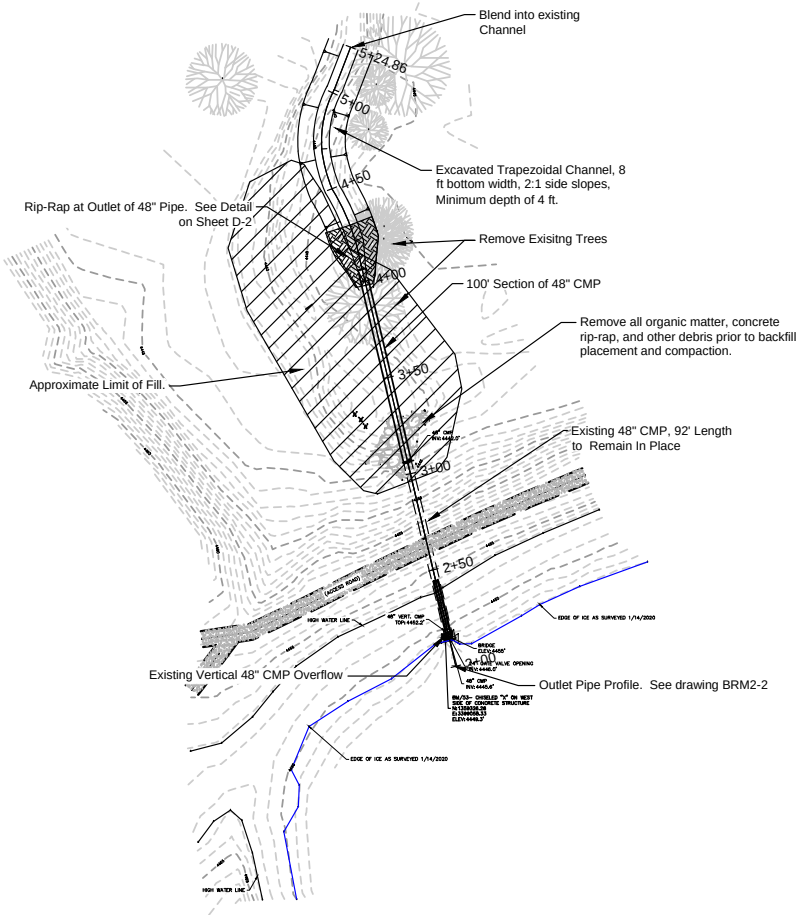
No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Berm 1 – Outlet Pipe Repair Profile

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970 689-1101 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	2–28–2020
Sheet No.	BRM1–2



NORTH

0 60 120 180 feet

SCALE: 1" = 60' (11x17)

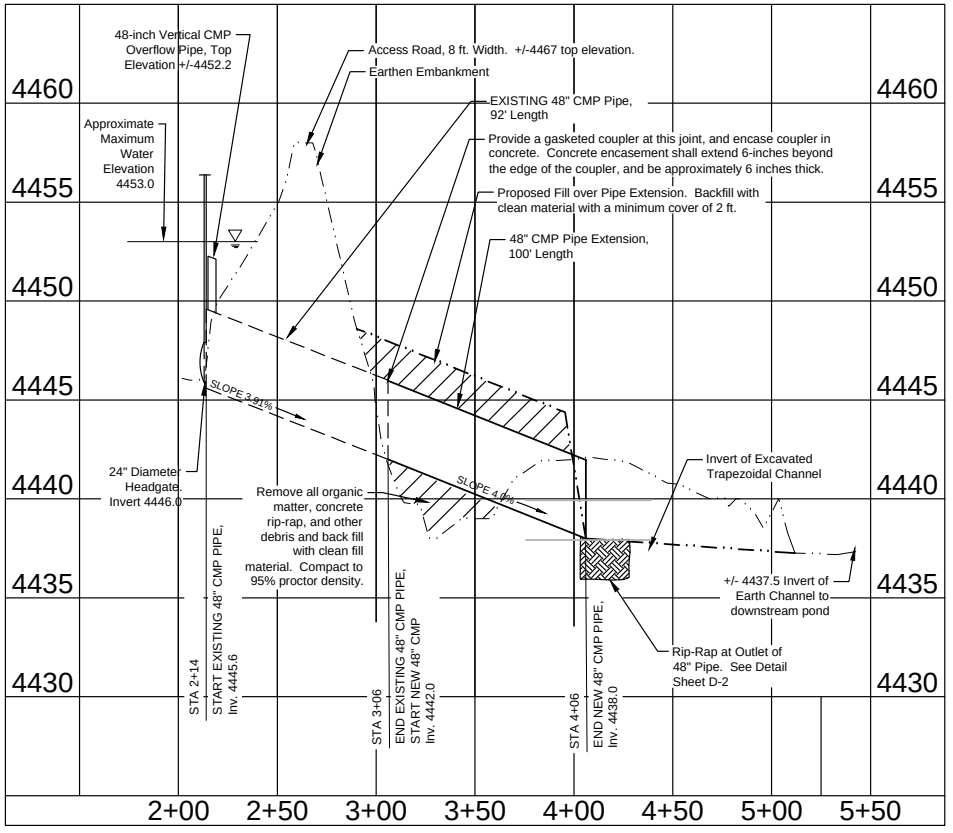
No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Berm 2 – Outlet Pipe Repair Plan

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-689-1601 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	2-28-2020
Sheet No.	BRM2-1



1 Berm 2 - Outlet Pipeline Profile
Station 1+00 to 3+50

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'

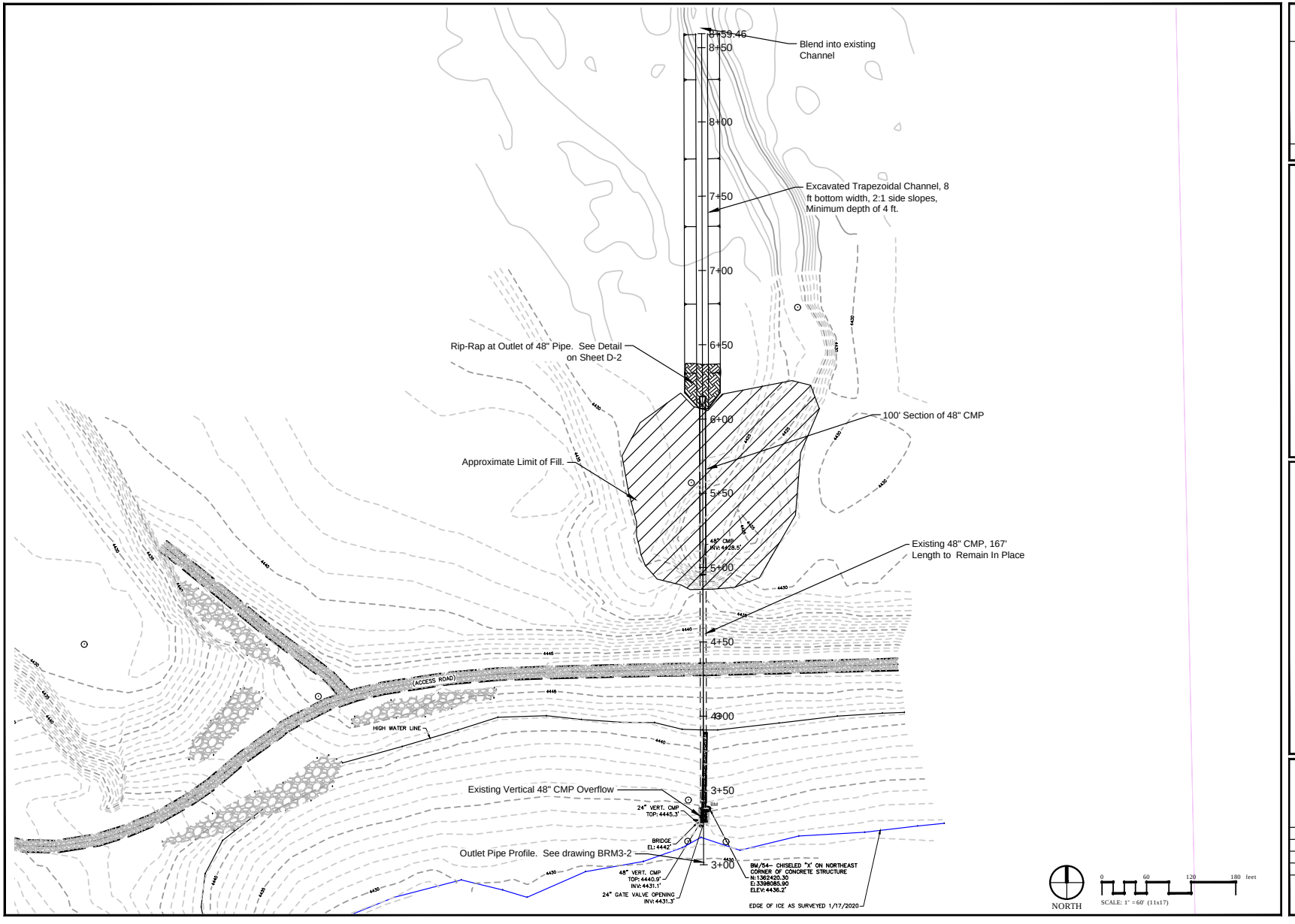
No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Berm 2 – Outlet Pipe Repair Profile

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970 689 1401 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	2–28–2020
Sheet No.	BRM2–2



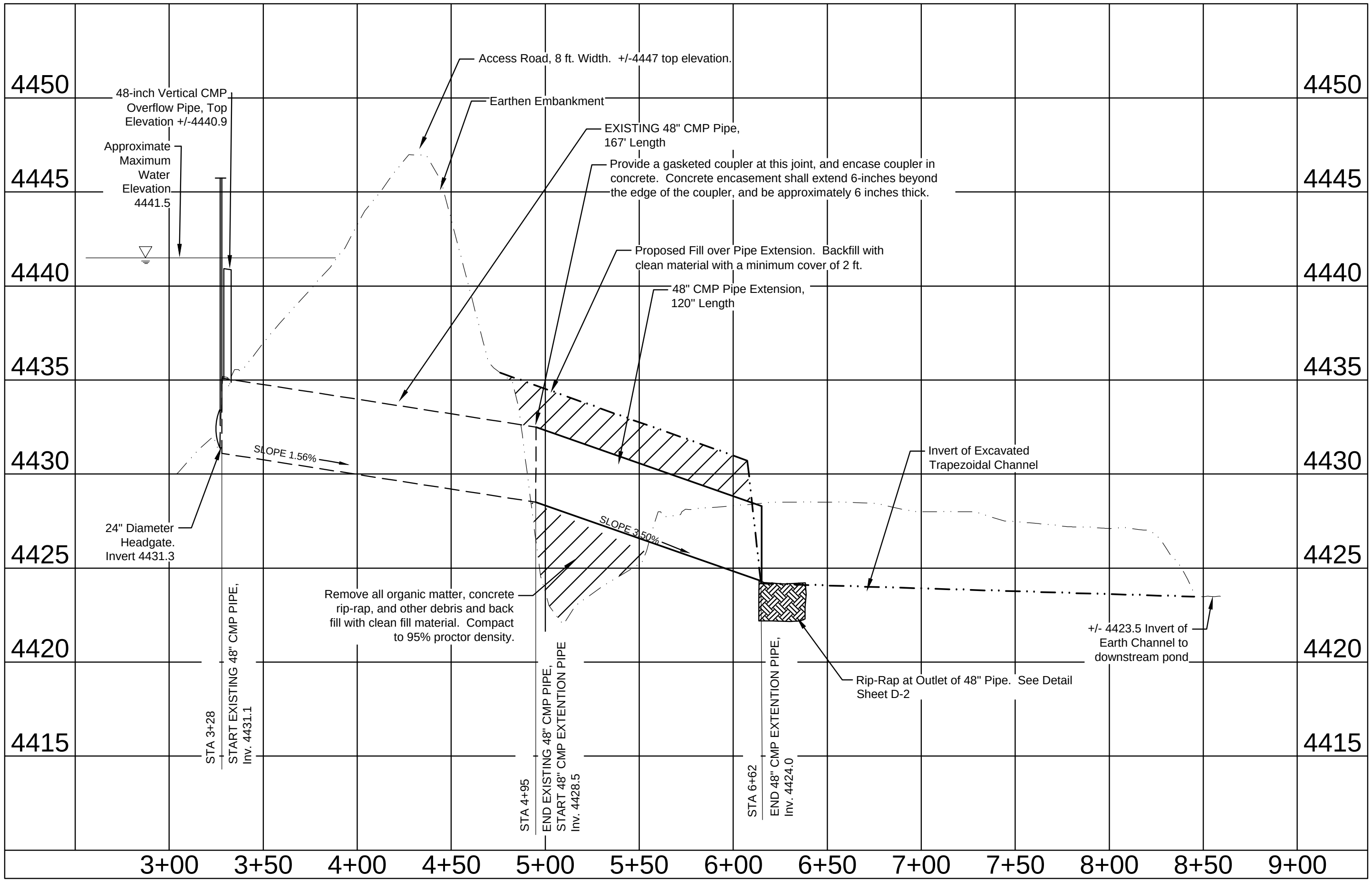
No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Berm 3 – Outlet Pipe Repair Plan

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1601 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	2-28-2020
Sheet No.	BRM3-1



Access Road, 8 ft. Width. +/-4447 top elevation.
Earthen Embankment
48-inch Vertical CMP Overflow Pipe, Top Elevation +/-4440.9
Approximate Maximum Water Elevation 4441.5
EXISTING 48" CMP Pipe, 167' Length
Provide a gasketed coupler at this joint, and encase coupler in concrete. Concrete encasement shall extend 6-inches beyond the edge of the coupler, and be approximately 6 inches thick.
Proposed Fill over Pipe Extension. Backfill with clean material with a minimum cover of 2 ft.
48" CMP Pipe Extension, 120" Length
Invert of Excavated Trapezoidal Channel
SLOPE 1.56%
SLOPE 3.50%
24" Diameter Headgate. Invert 4431.3
Remove all organic matter, concrete rip-rap, and other debris and back fill with clean fill material. Compact to 95% proctor density.
+/- 4423.5 Invert of Earth Channel to downstream pond
Rip-Rap at Outlet of 48" Pipe. See Detail Sheet D-2
STA 3+28
START EXISTING 48" CMP PIPE, Inv. 4431.1
STA 4+95
END EXISTING 48" CMP PIPE, START 48" CMP EXTENTION PIPE Inv. 4428.5
STA 6+62
END 48" CMP EXTENTION PIPE, Inv. 4424.0
4450
4445
4440
4435
4430
4425
4420
4415
3+00
3+50
4+00
4+50
5+00
5+50
6+00
6+50
7+00
7+50
8+00
8+50
9+00

1 Berm 3- Outlet Pipeline Profile

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'

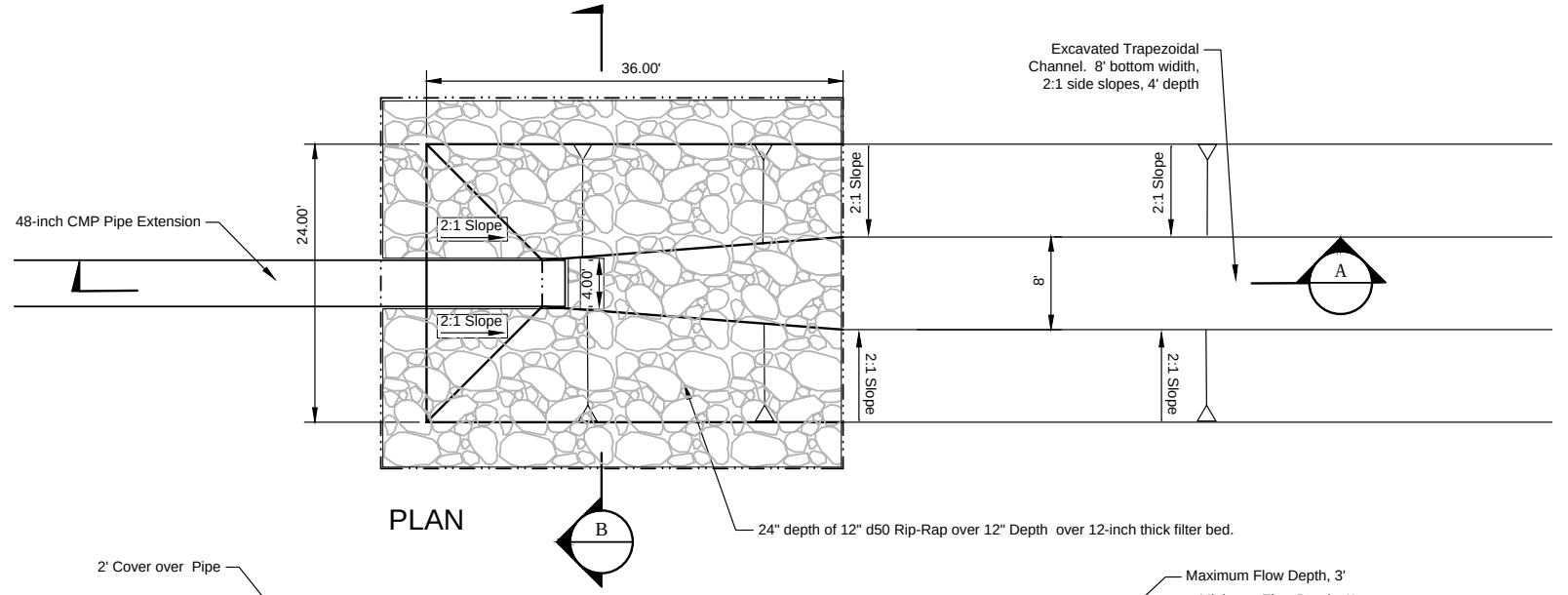
No.	Revisions:	Date:

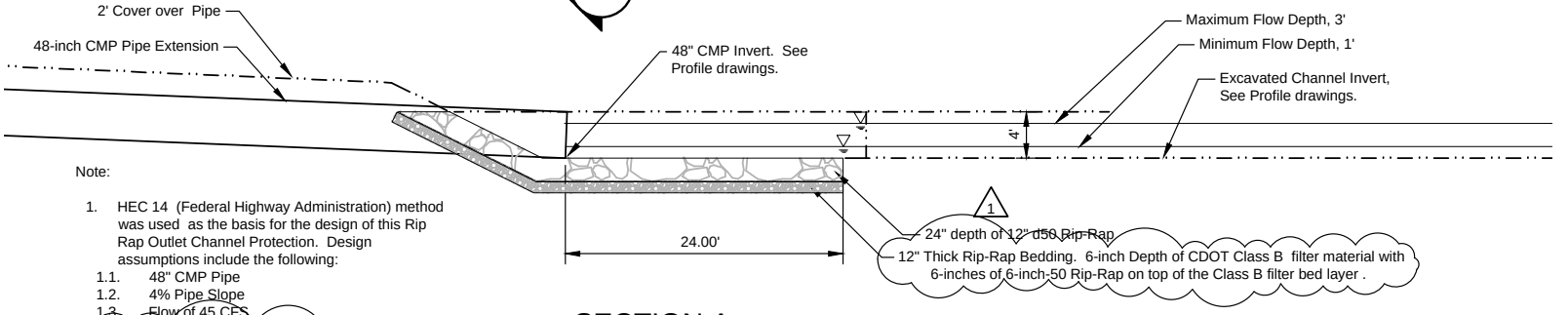
CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Berm 3- Outlet Pipe Repair Profile

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1001 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	2-28-2020
Sheet No.	BRM3-2

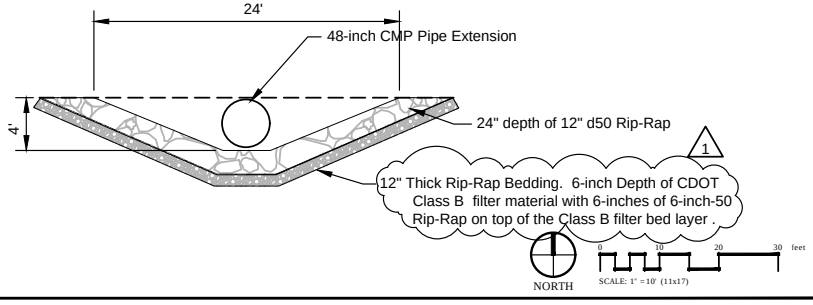




Note:

1. HEC 14 (Federal Highway Administration) method was used as the basis for the design of this Rip Rap Outlet Channel Protection. Design assumptions include the following:
   - 1.1. 48" CMP Pipe
   - 1.2. 4% Pipe Slope
   - 1.3. Flow of 45 CFS
   - 1.4. 12" d50 Rip-Rap, 24" depth
   - 1.5. Rip-Rap FilterBed, , 12" depth (1)
2. Rip-Rap Area = 1450 square feet
   - 2.1. 110 CuYds. of 12" d50 Rip-Rap
   - 2.2. 30 CuYds. of CDOT Class B Filter Bed Material
   - 2.3. 30 Yards of 6-inch d50 Rip-Rap

SECTION A



1 Typical Rip-Rap Apron for Culvert Outlet

No.	Revisions:	Date:
1	Revise filter bed notes:	3-27-20:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Typical Rip-Rap Apron at Culvert Outlet

Wayne E. Eckas, P.E.
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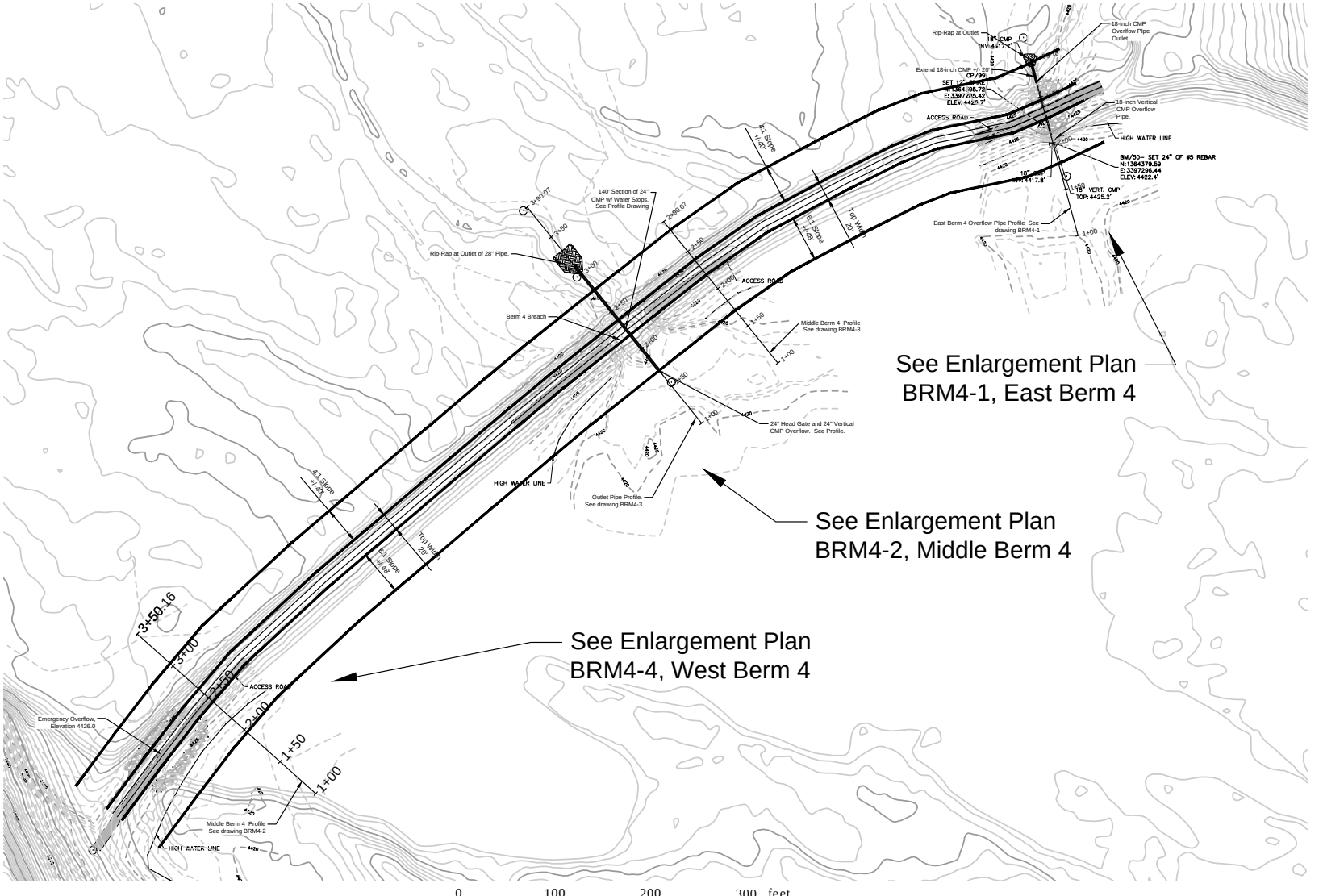
Fort Collins, CO 80526
970-690-1601 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	2-26-2020
Sheet No.	D-2



1 West Berm 4 - Overall Plan

NORTH

0 100 200 300 feet

SCALE: 1" = 100'

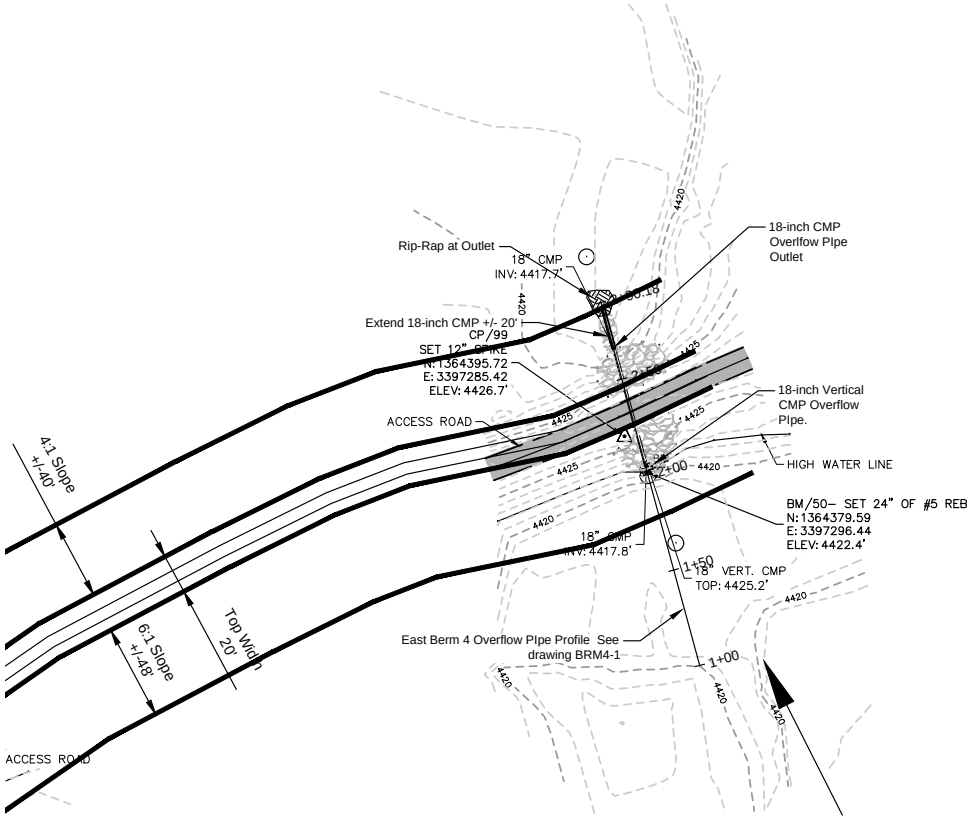
No.	Revisions:	Date:

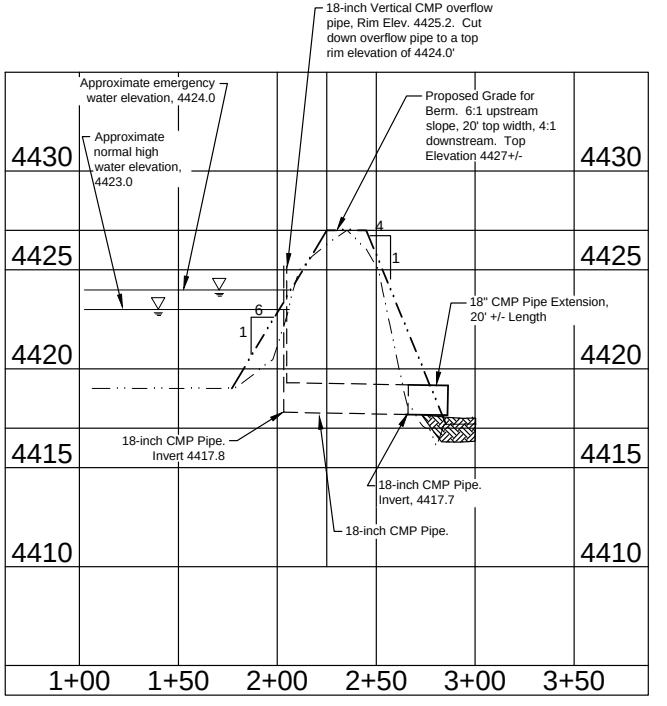
CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Berm 4 – Overall Plan

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1601 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	6-10-2020
Sheet No.	BRM4-0





NORTH

0 60 120 180 feet

SCALE: 1" =60' (11x17)

1 East Berm 4 - Overflow Plan

2 East Berm 4 Overflow Pipe Profile

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'

No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

East Berm 4 – Enlargement Plan and Profile

Wayne E. Eckas, P.E.
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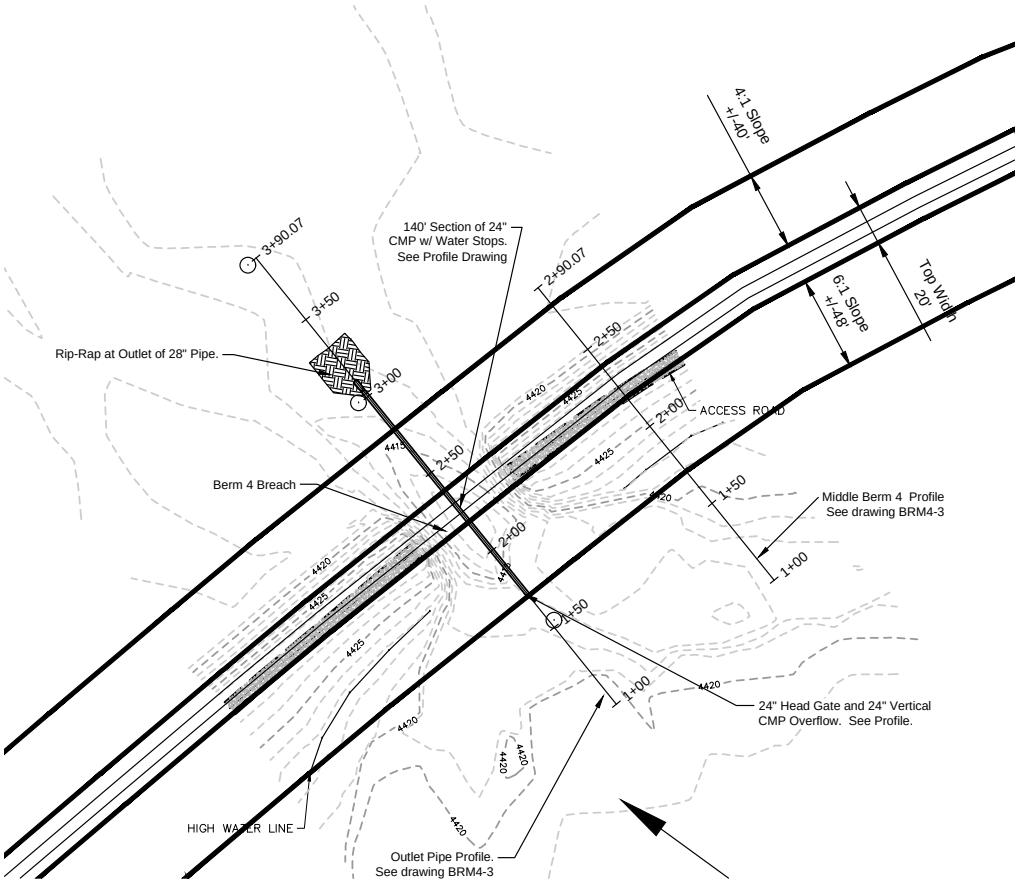
Fort Collins, CO 80526
970-689-1601 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	6-10-2020
Sheet No.	BRM4-1



1 Middle Berm 4 - Plan

NORTH

0 60 120 180 feet

SCALE: 1" =60' (11x17)

No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Middle Berm 4 – Enlargement Plan

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
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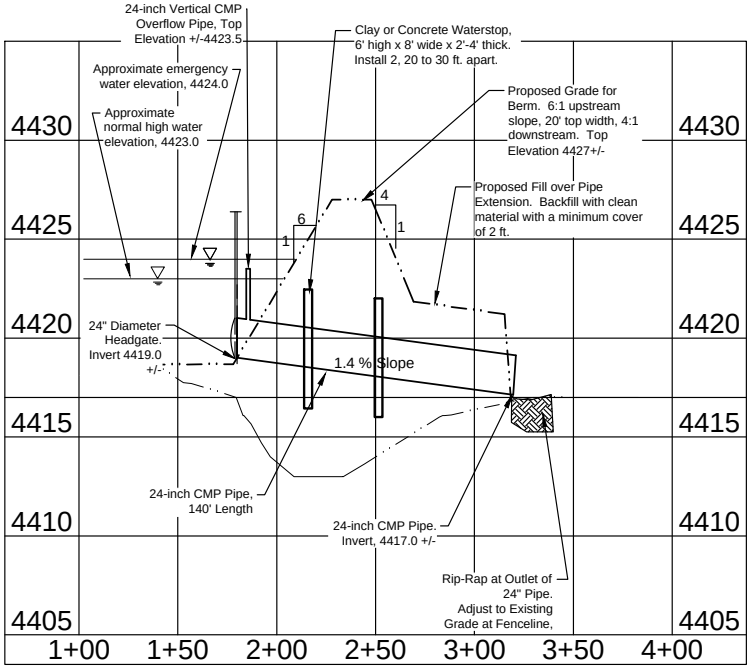
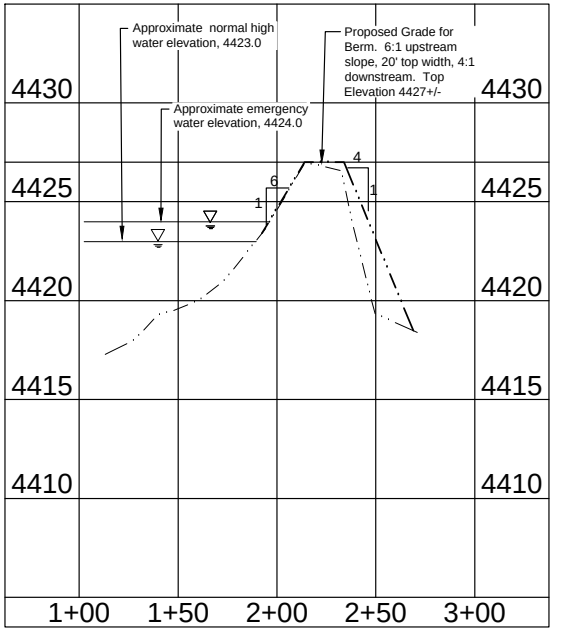
Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	6-10-2020
Sheet No.	BRM4-2



1 Middle Berm 4 - Outlet Pipe Profile

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'



2 Middle Berm 4- Profile

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'

No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

Middle Berm 4 – Profiles

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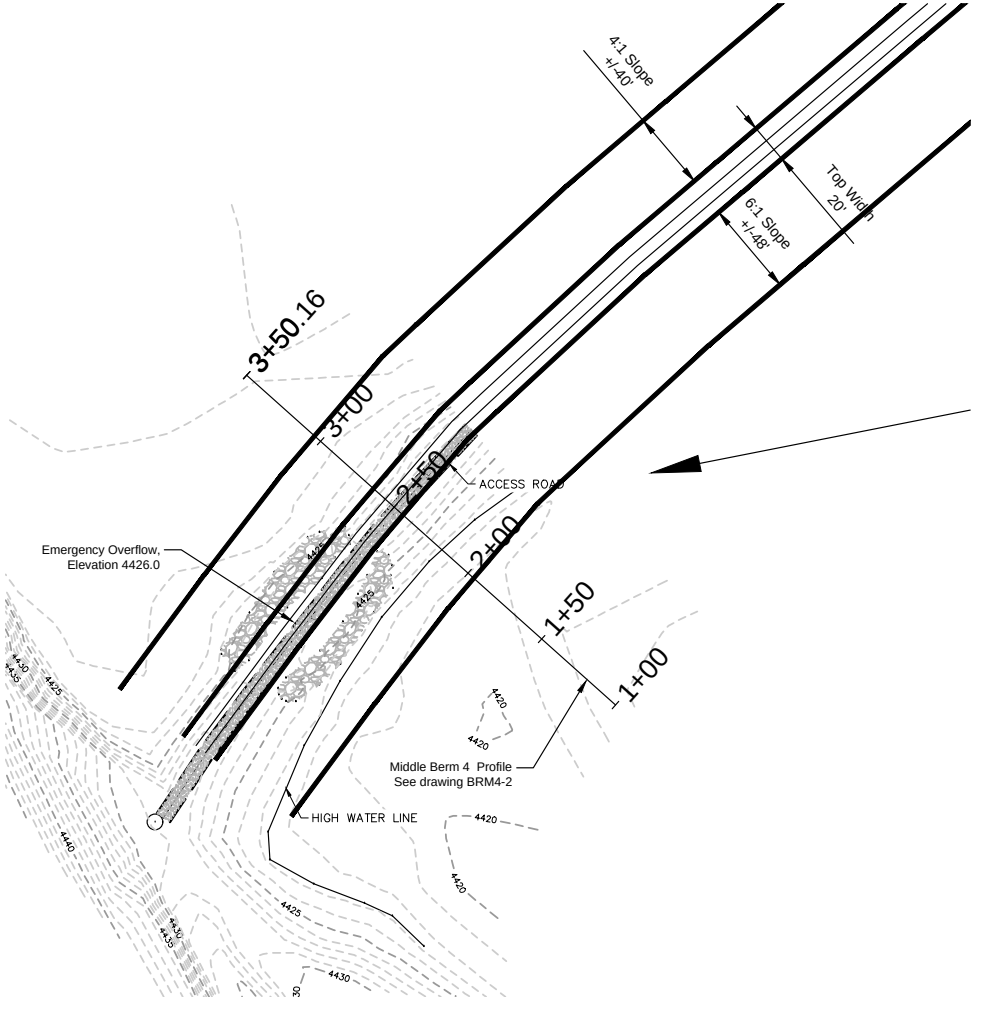
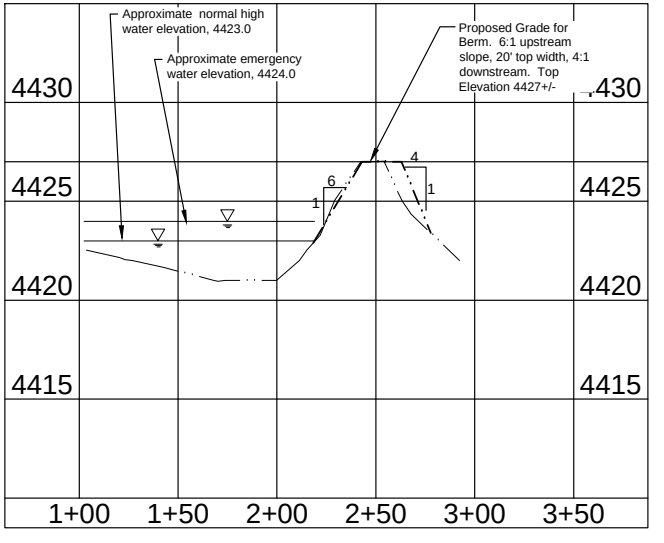
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1401 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	6-2-2020
Sheet No.	BRM4-3





NORTH

0 60 120 180 feet

SCALE: 1" = 60' (11x17)

1 West Berm 4 - Plan

2 WEst Berm 4 - Profile

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'

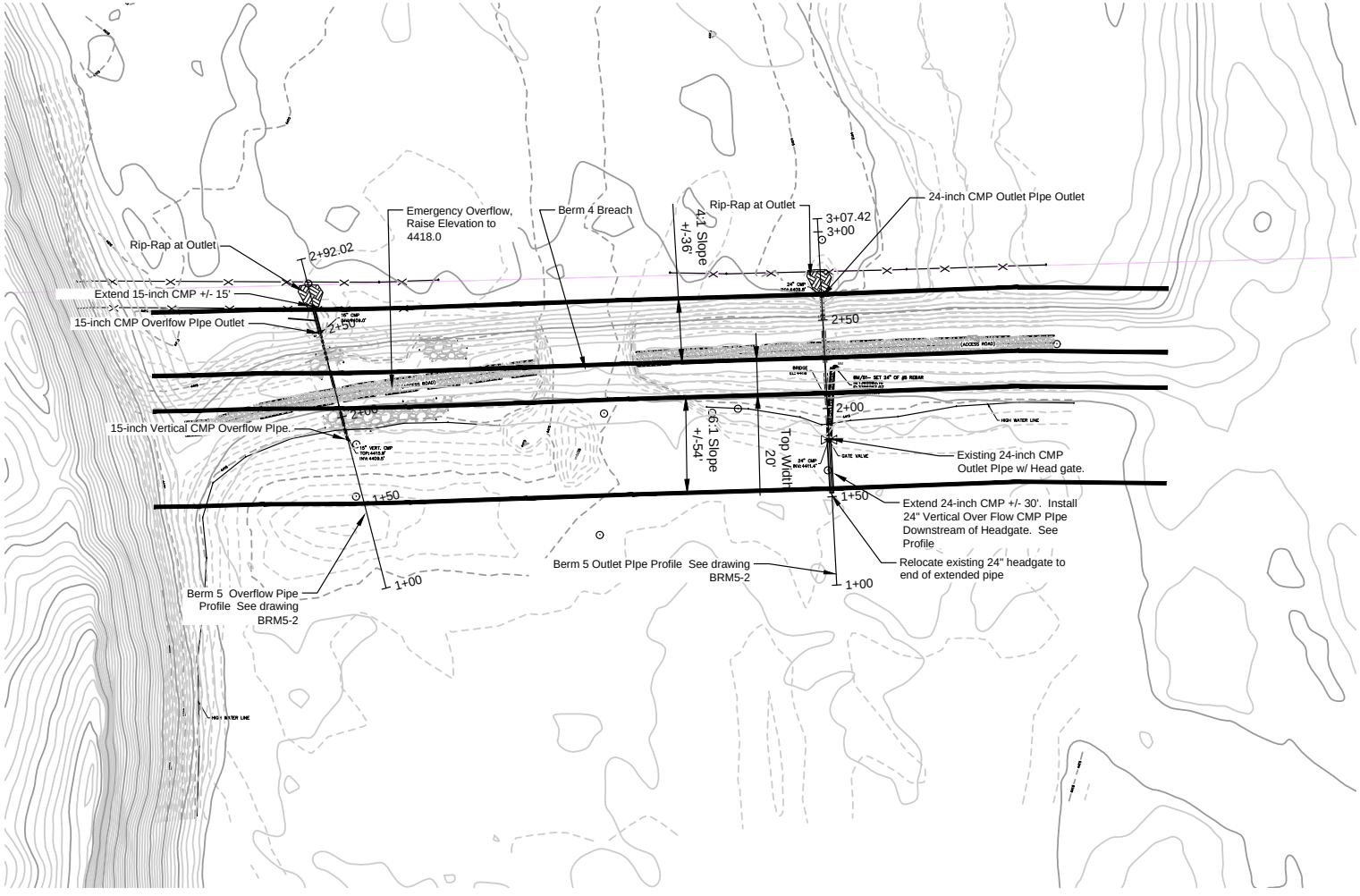
No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

West Berm 4 – Enlargement Plan and Profile

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-689-1401 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	6-2-2020
Sheet No.	BRM4-4



1 West Berm 5 - Plan

NORTH

0 60 120 180 feet

SCALE: 1" = 60' (11x17)

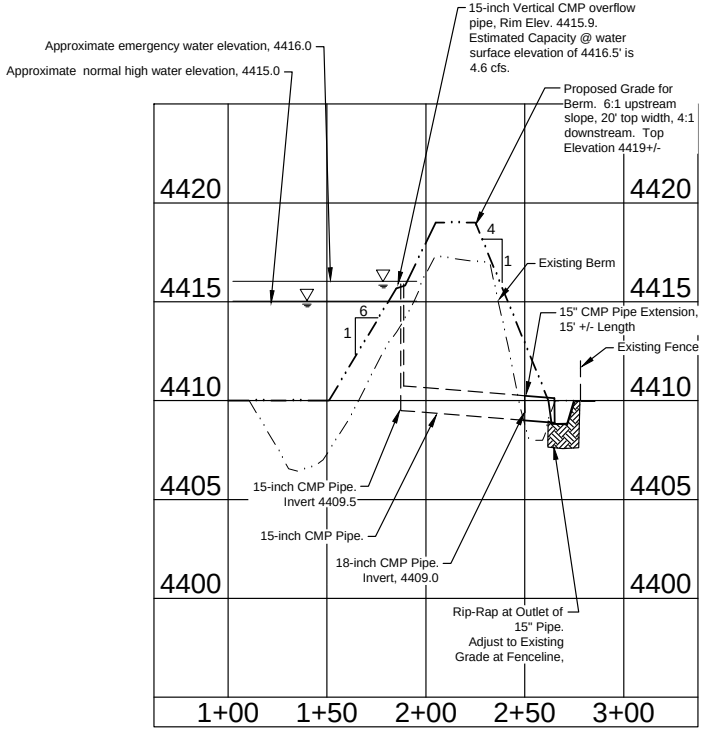
No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

West Berm 5 – Enlargement Plan

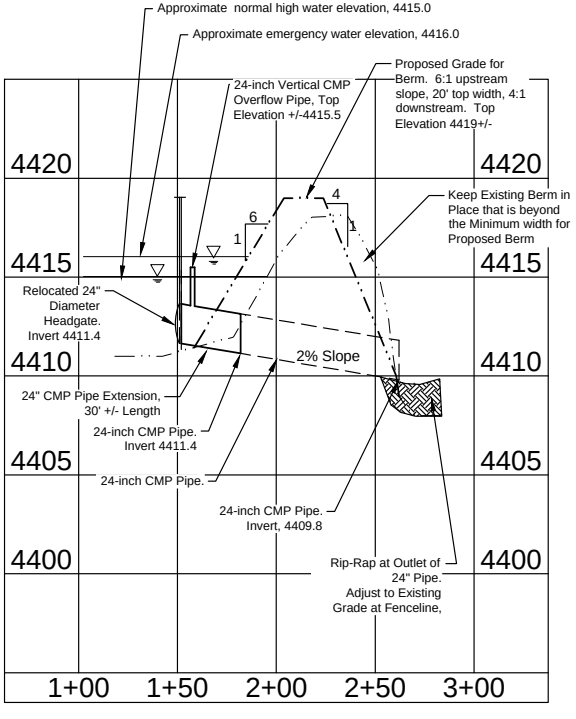
Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-690-1401 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	6-10-2020
Sheet No.	BRM5-1



1 Berm 5 - Overflow Pipe Profile

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'



2 Berm 5 - Outlet Pipe profile

Horizontal Scale = 1"= 60'
Vertical Scale 1" = 6'

No.	Revisions:	Date:

CENTRAL COLORADO WATER CONSERVANCY DISTRICT
Kiowa Recharge Project
Morgan County, Colorado

West Berm 5 – Profiles

Wayne E. Eckas, P.E.
1514 Ambrosia Court
Fort Collins, CO 80526
970-689-1401 (Cell)

Designed By:	WEE
Drawn By:	WEE
Checked By:	WEE
Date:	6-10-2020
Sheet No.	BRM5-2

7.4 OWW Kiowa Geotech Report

EARTH ENGINEERING CONSULTANTS, LLC

April 13, 2020

Central Colorado Water Conservancy District
c/o Eckas Water
1514 Ambrosia Court
Fort Collins, Colorado 80526

Attn: Mr. Wayne Eckas (wayne@eckaswater.com)

Re: Subsurface Exploration and Geotechnical Engineering
Kiowa Recharge
Morgan County, Colorado
EEC Project No. 3202001

Mr. Eckas:

Earth Engineering Consultants, LLC (EEC) personnel have completed the subsurface exploration you requested to develop information for the improvements planned at the Kiowa Recharge system generally located in the reach of the Kiowa Creek, south of SH 144 and west of CR 5, near Orchard, Colorado. This exploration and engineering evaluation were carried out in general accordance with our proposal dated February 3, 2020.

INTRODUCTION

The Kiowa Recharge is a water augmentation system that consists of five recharge reservoirs that are filled from the Bijou Canal. The reservoirs are spaced, progressively downstream within the Kiowa Creek with the uppermost reservoir impounded by Dam #1 and the lowest reservoir impounded by Dam #5 (Figure 1). The dams are classified as Non-Jurisdictional, Low Hazard structures (Colorado Division of Water Resources, November 11, 2019).

We understand Dam #4 and Dam #5 exhibited breach failures on November 2, 2019. The failure at Dam #4 was likely caused by excessive seepage around the outlet pipe which caused significant piping and erosion around the outlet pipe (Photos 1 and 2). The outlet pipe of Dam #4 was observed

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(970) 867-1224 (FAX) 663-0282
www.earth-engineering.com

in the washout below the breached area (Photo 3). The failure of Dam #5 was identified as being caused by a cascading failure from Dam #4 (Colorado Division of Water Resources, November 11, 2019) (Photo 4).

As requested, EEC personnel were requested to provide geotechnical engineering consultation services for the repairs of the breached sections of Dam #4 and Dam #5 and provide recommendations for improvements to Dam #4 and Dam #5 to increase their stability and long-term performance. Note that our services were limited to Dam #4 and Dam #5 and excludes Dam #1, Dam #2, and Dam #3 which would be provided by others. In general, our services included subsurface exploration and geotechnical engineering evaluation of the dam embankment and foundation subgrades, modeling seepage and stability of the existing embankment geometry, and providing geotechnical engineering recommendations for improvements as necessary. Our services do include evaluation of hydrology, overall reservoir seepage/recharge, or appurtenance structures to the embankment itself.

EXPLORATION AND TESTING PROCEDURES

To develop information of the existing subsurface conditions, two (2) test borings were advanced in each of the dam alignments (four (4) total), extending to depths of approximately 30 feet below the dam crest elevations. The boring locations were selected and established in the field by EEC personnel by pacing and estimating angles from identifiable site references. The locations of the test borings should be considered accurate only to the degree implied by the methods used to make the field measurements. Individual boring logs and a diagram indicating the approximate boring locations (Figure 2) are included with this report.

The borings were completed using a truck mounted, CME-55 drill rig equipped with a hydraulic head employed in drilling and sampling operations. The boreholes were advanced using 4¼-inch inside diameter hollow-stem continuous flight augers. Samples of the subsurface materials encountered were obtained using split-barrel, California barrel sampling procedures in general accordance with ASTM Specifications D1586 and D3550, respectively. Additional bulk samples of the subgrade soils were obtained from the auger cuttings.

In the split-barrel and California barrel sampling procedures, standard sampling spoons are driven into the ground by means of a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the split-barrel and California barrel samplers is recorded and is used to estimate the in-situ relative density of cohesionless soils and, to a lesser degree of accuracy, the consistency of cohesive soils. In the California barrel sampling procedure, relatively intact samples are recovered in removable brass liners. All samples obtained in the field were sealed and returned to our laboratory for further examination, classification and testing.

Laboratory testing on each of the recovered samples included visual classification and moisture content tests. Atterberg limits and washed sieve analysis tests were completed on selected samples to evaluate the quantity and plasticity of fines in the subgrades. Standard Proctor, permeability, and direct shear tests were carried out to evaluate the soil's compaction characteristics, hydraulic conductivity, and shear strength, respectively. Results of the completed laboratory tests are indicated on the attached boring logs and summary sheets.

As part of the testing program, all samples were examined in the laboratory and classified in general accordance with the attached General Notes and the Unified Soil Classification System, based on the soil's texture, plasticity and grain size distribution. The estimated group symbol for the Unified Soil Classification System is indicated on the boring logs and a brief description of that classification system is included with this report.

SITE AND SUBSURFACE CONDITIONS

Site Description

The Kiowa Recharge system is located within Sections 3, 10, 14 and 15, Township 4 North, Range 60 West of the 6th Principle Meridian. The recharge system is located within the Kiowa Creek, generally extending between the Bijou Canal and the South Platte River.

Geologic Description

The site geology presented in this report is based upon review of listed literature and maps, and previous experience with similar geologic conditions in this area. The locations of geologic

features are approximate and should be considered accurate only to the degree implied by the methods used to identify those features.

Review of available literature indicates the surficial soils at the project site are described as Active Channel and Floodplain Alluvium (Qaa) and Young Alluvium (Qa1 and Qa2) of late Holocene age in the central portion of the channel and Sidestream Deposits of Broadway Alluvium (late Pleistocene) towards the outer reaches of the channel morphology. The channel alluvium deposits generally classify as poorly to well sorted fine to medium grained sand stratum interstratified with silts and clays deposited within the confines of Bijou Creek, overlying the Pierre Shale (Upper Cretaceous) at depths generally greater than 150 feet below site grades as illustrated by the Geologic map of the Orchard 7.5' quadrangle, Morgan County, Colorado by Berry, M.E., Slate, J.L., Hanson, P.R., and Brandt, T.R.; US Geological Survey, Scientific Investigations Map SIM-3331, 2015.

The Colorado Geological Survey (CGS) reports potentially active faults 60 miles south-southwest of the project site. These distant faults (Rock Creek Fault and Walnut Creek Fault) are reported to be Class B Quaternary Faults and could be capable of producing a magnitude 6.0 earthquake.

Subsurface Conditions

EEC personnel were on site during the drilling operations to evaluate the subsurface conditions encountered and direct the drilling activities. Field logs prepared by EEC site personnel were based on visual and tactual observation of auger cuttings and disturbed samples. The boring logs included with this report may contain modifications to the field logs based on results of laboratory testing and engineering evaluation. Based on results of the field boring and laboratory testing, subsurface conditions can be generalized as follows.

The subgrades encountered at the boring locations consisted of previously placed fill materials (existing embankment) which were identified as poorly graded sand with silt, which, at the specific boring locations, extended to depths of approximately 7 to 12 feet below the dam crest. The existing embankment materials were medium dense and appeared relatively consistent. Underlying the existing embankment materials were native materials consisting of poorly graded sand (generally containing less fines content than the existing embankment materials) which

extended to the bottom of the completed test borings. The native materials were predominantly medium dense to dense.

The stratification boundaries indicated on the boring logs represent the approximate locations of changes in soil and rock types; in-situ, the transition of materials may be gradual and indistinct.

Groundwater

Observations were made while drilling and after completion of borings to detect the presence and depth to groundwater. During the drilling operations, groundwater was encountered in three of the test borings at depths ranging from approximately 24 to 25 feet below ground surface.

Fluctuations in groundwater levels can occur over time depending on variations in hydrologic conditions and other conditions not apparent at the time of this report. At the time of drilling, the reservoirs were empty; thus, groundwater was considered to be at a relatively low elevation. The groundwater levels would be expected to rise with the levels in the reservoirs. Anticipated piezometric levels developing during high water levels in the reservoirs are shown in the attached seepage analyses attached with this report.

Long-term monitoring of water levels in the piezometers, or cased wells, which are sealed from the influence of surface water, would be required to more accurately evaluate the depth and fluctuations in groundwater levels at the site.

Physical Characteristics of Subgrades

The site materials encountered include existing embankment materials consisting of poorly graded sand with silt, and native subgrade materials consisting of poorly graded sand. Laboratory testing on select samples of the included Atterberg limits and washed sieve analysis to classify the soil, with standard Proctor, direct shear, and/or falling head permeability tests performed to evaluate the material's moisture-density relationship, shear strength, and hydraulic conductivity, respectively. The results of the laboratory testing are included with this report on the attached boring logs or summary sheets. The physical properties of the materials encountered in the borings are summarized in the following sections. Note that variations in materials and physical properties

of those materials may vary from boring location to boring location, and between and away from the boring locations. The parameters outlined below do not include any safety factors. Appropriate reductions and/or factors of safety should be considered to account for slight variability in the subgrades.

Existing Embankment

The poorly graded sand with silt soils were low- to non-plastic with plastic indices predominantly non-plastic to occasional samples up to 12%. Fines content (material finer than the standard No. 200 sieve) ranged from approximately 5 to 11%. Direct shear testing on remolded samples indicated peak friction angles ranging from 34.1° to 35.0° and cohesion of 68 to 93 psf, and ultimate friction angles ranging from 33.4° to 33.7°, and cohesion of 25 to 58 psf. Falling head permeability testing, carried out on two specimens which were remolded near 90% of the material's standard Proctor maximum dry density indicated coefficients of permeability of approximately $4.69x10^{-4}$ cm/s and $1.14x10^{-3}$ cm/s.

Native Subgrades

The poorly graded sand subgrades were non-plastic and contained approximately 2 to 7% fines content (material finer than the standard No. 200 sieve). In general, the native subgrades were similar to the overlying embankment materials.

ANALYSIS AND RECOMMENDATIONS

Analysis of Existing Dams

To evaluate the long-term stability of the current configuration of the embankments (prior to breaches), EEC personnel carried out seepage and slope stability modeling using various information provided and the subsurface information attained as part of this exploration.

The geometry of the embankments was provided by Eckas Water and included various sections of Dam #4 and Dam #5. Based on our review of those sections, one section was selected for analysis which we believe reflects the majority of the geometry of the dams; however, it should be noted

that additional isolated sections may exist at slightly more critical geometries (i.e. narrower width, steeper slopes, etc.); therefore, our analysis assumes that any other more critical sections would be improved to the typical section assumed.

Based on the design documents provided, the existing geometry can be described as having an upstream slope of 6:1, downstream slope of 2:1, crest width of 19 feet, upstream dam height of 7 feet, and downstream height of 11 feet, with maximum water levels 2 feet below the crest elevation. The typical section as described is shown in Figure 3. Based on the subsurface conditions encountered, the embankment consists of poorly graded sand with silt, with the underlying native subgrades consisting of poorly graded sand. Soil parameters used in our analyses are included below in Table 1. Those soil parameters, which were used in our analysis, may vary from those actually determined as part of this exploration to reflect conservative conditions or were estimated based on our experience with similar materials and/or available literature. Such variations/assumptions used in the design include:

- Embankment: chosen friction angle and cohesion was less than determined in laboratory testing as indicated in the section *Existing Embankment*. Material was assumed to be a relatively homogeneous, isotropic material.
- Native Subgrades: chosen shear strength parameters were assumed to be similar to the embankment materials based on classification testing and our experience with similar materials and available literature. The permeability of the native subgrades was estimated based on overall seepage estimates provided by Eckas Water.

Table 1. Summary of soil parameters used in seepage and stability analyses.

Soil Zone	Soil Description	Unit Weight	Coefficient of Permeability	Effective Friction Angle, ϕ'	Effective Cohesion, C'
Embankment/Fill	Poorly Graded Sand with Silt	130 pcf	3.23 ft/d	33.0	10
Subgrade/Native	Poorly Graded Sand	130 pcf	0.5 ft/d	33.0	0

Seismic parameters for the site were determined based on our review of available literature and design maps (U.S. Seismic Design Maps, 2020). Based on the project site location and consider

the site a Risk Category of I and Site Class D, a design peak ground acceleration (PGA) of 0.057 was determined based on ASCE 7-16 criteria.

The stability analyses were evaluated using Morgenstern-Price method of slices modeled in SlopeW software provided by GeoStudio. Porewater pressures were modeled using SeepW software. Soil parameters used in the analyses were obtained from the conditions observed, the results of laboratory testing, and/or estimated from available geotechnical information. The results of the slope stability analyses are summarized in Table 2 with the results shown for Section 1 (Existing Section) in Figures 3 through 5. Note that since Dam #4 and Dam #5 are considered Low Hazard (Colorado Division of Water Resources, November 11, 2019), a seismic analysis was not conducted as only required for High or Significant hazard dams (Colorado Division of Water Resources, January 2007).

Table 2. Summary of safety factors for slope stability for Section 1 (Existing Section).

Scenario	Soil Condition	Minimum Safety Factor	Safety Factor Determined
Steady Seepage at High Water Level	Drained	1.5	0.9

Based on our seepage and stability analyses, the critical slip surface was found to be 0.9, suggesting the existing embankments are in an unsafe condition when reserving water at the high-level mark. In our opinion, the model accurately reflects the field conditions as evident by the recent failures observed in the field. We recommend that existing dam embankments are improved to develop an acceptable safety factor. Recommendations to improve the dams are included in the section Dam Improvements.

Dam Improvements

The Dam #4 and Dam #5 embankment configurations currently exist in a relatively unstable condition. Improvements to their configurations are recommended to develop long-term stability and safety of those embankments. In general, improvements for stability would either be developed by reducing seepage through the dam or increasing the footprint of the dam. The following recommendations are provided based on our understanding of the client's desire to utilize site materials for improvements to the dam, rather than importing select materials at a

significantly higher expense. Possible alternative methods for improvements could include, but not limited to, installation of an upstream low permeability liner, stabilizing upstream embankment materials, and/or installation of a drain system within the embankment. EEC could provide alternative methods if requested.

To increase the stability of the Dam #4 and Dam #5, we recommend the geometry (as defined by (Colorado Division of Water Resources, January 2007)) of the embankments are improved as follows:

- Upstream Slopes: 6:1 or Flatter
- Downstream Slopes: 4:1 or Flatter
- Width of Crest: 20 feet Minimum
- Freeboard: Greater of 3 feet or as Required by Hydraulic Design
- Jurisdictional Height: 10 feet or Less

To develop the recommended geometry, and to repair the breach areas, prior to making any cuts or fills, we recommend the impounded reservoirs are lowered to develop safe excavations as determined by the individual excavating contractors. In areas to receive fill, we recommend any existing vegetation and/or debris be removed within the breach sections. Additionally, any loose and disturbed subgrades should be removed. In areas where tree or shrub root systems exist, the entire root system and any dry and/or desiccated soils surrounding the root systems should also be removed. Rodent holes should be completely excavated to competent materials. After stripping areas to receive fill, adjacent slopes should be benched to develop minimum of 4:1 (horizontal to vertical) slopes or as appropriate to accommodate compaction equipment. After stripping and completing all cuts and prior to placement of any fill, we recommend the exposed subgrades, including all benched slopes be scarified to a depth of 9 inches, adjusted in moisture content and compacted to at least 95% of the material's maximum dry density as determined in accordance with ASTM Specification D698, the standard Proctor procedure. The moisture content of the scarified soils should be adjusted to near optimum moisture content to facilitate proper compaction.

Fill materials should consist of approved, low volume change materials free of organic matter and debris. In our opinion, the site soils consisting of sand with various amounts of silt could be used

as fill materials. The fill materials should be placed in 9-inch loose lifts, adjusted in moisture, and compacted as recommended for the scarified materials. Care will be needed to see that sufficient bonds are developed between the lifts. We recommend the use of a sheep-foot mechanical compactor to provide a kneading type of compaction. A smooth-drum roller is not recommended.

The site materials are relatively sandy and exhibit low cohesion. As a result, those materials would be highly subject to erosion. Placed earthen embankment fill materials should be sufficiently protected from erosion, wave action, and piping when the reservoir is filled and also from excessive drying, desiccation, cracking and rutting when the reservoir is at low capacity. Outlet structures should be properly designed to prevent erosion and scour at the outlet and designed to prevent piping around any of the outlet works. Spillways should be incorporated into the improvements to maintain freeboard requirements. When designing spillways, care should be taken that those spillways are diverted around the embankments or incorporate proper mechanisms to protect the embankment materials from erosion and scour. We recommend the owner institute an inspection program subsequent to construction to periodically verify that the design recommendations are maintained.

For the Dam #4 and Dam #5 embankments improved as recommended above, seepage and slope stability analyses were evaluated using the methods and material properties as described in the section titled *Existing Embankments*. The results of the slope stability analyses are summarized in Table 3 below with the results shown for Section 1 (Improved Section) in Figures through 6 through 8. As indicated previously, seismic analysis was not carried out since the dams are considered Low Hazard (Colorado Division of Water Resources, November 11, 2019).

Table 3. Summary of safety factors for slope stability for Section 1 (Improved Section).

Scenario	Soil Condition	Minimum Safety Factor	Safety Factor Determined
Steady Seepage at High Water Level	Drained	1.5	1.5

Based on our seepage and stability analyses, the safety factor for the critical slip surface was found to be 1.5; which meets the requirements of at least 1.5 (Colorado Division of Water Resources, January 2007).

GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations which may occur between borings or across the site. The nature and extent of such variations may not become evident until further exploration or construction. If variations appear evident, it will be necessary to re-evaluate the recommendations of this report.

It is recommended that the geotechnical engineer be retained to review the plans and specifications, so comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. It is further recommended that the geotechnical engineer be retained for testing and observations during earthwork construction phases to help determine that the design requirements are fulfilled.

This report has been prepared for the exclusive use of Central Colorado Water Conservancy District and Eckas Water for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranty, express or implied, is made. In the event that any changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions of this report are modified or verified in writing by the geotechnical engineer.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we can be of further service to you in any other way, please do not hesitate to contact us.

Very truly yours,

Earth Engineering Consultants, LLC

Ethan P. Wiechert, P.E.
Senior Geotechnical Engineer

Reviewed by: David A. Richer, P.E.
Senior Geotechnical Engineer

cc: CCWCD – Randy Ray (rray@ccwcd.org)

References

Colorado Division of Water Resources. (January 2007). *Rules and Regulations for Dam Safety and Dam Construction.*

Colorado Division of Water Resources. (November 11, 2019). *Kiowa Recharge Area Dams #4 and #5 Failure Site Visit.* Dam Safety.

U.S. Seismic Design Maps. (2020). Retrieved from https://seismicmaps.org.

DRILLING AND EXPLORATION

DRILLING & SAMPLING SYMBOLS:

SS: Split Spoon - 13/8" I.D., 2" O.D., unless otherwise noted
ST: Thin-Walled Tube - 2" O.D., unless otherwise noted
R: Ring Barrel Sampler - 2.42" I.D., 3" O.D. unless otherwise noted
PA: Power Auger
HA: Hand Auger
DB: Diamond Bit = 4", N, B
AS: Auger Sample
HS: Hollow Stem Auger
PS: Piston Sample
WS: Wash Sample
FT: Fish Tail Bit
RB: Rock Bit
BS: Bulk Sample
PM: Pressure Meter
WB: Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
WCI: Wet Cave in
DCI: Dry Cave in
AB : After Boring
WS : While Sampling
WD : While Drilling
BCR: Before Casing Removal
ACR: After Casting Removal

Water levels indicated on the boring logs are the levels measured in the borings at the time indicated. In pervious soils, the indicated levels may reflect the location of ground water. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION

Soil Classification is based on the Unified Soil Classification system and the ASTM Designations D-2488. Coarse Grained Soils have move than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as : clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Consistency
< 500	Very Soft
500 - 1,000	Soft
1,001 - 2,000	Medium
2,001 - 4,000	Stiff
4,001 - 8,000	Very Stiff
8,001 - 16,000	Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
80 +	Extremely Dense

PHYSICAL PROPERTIES OF BEDROCK

DEGREE OF WEATHERING:

Slight	Slight decomposition of parent material on joints. May be color change.
Moderate	Some decomposition and color change throughout.
High	Rock highly decomposed, may be extremely broken.

HARDNESS AND DEGREE OF CEMENTATION:

Limestone and Dolomite:

Hard	Difficult to scratch with knife.
Moderately Hard	Can be scratched easily with knife.
Hard	Cannot be scratched with fingernail.
Soft	Can be scratched with fingernail.

Shale, Siltstone and Claystone:

Hard	Can be scratched easily with knife, cannot be scratched with fingernail.
Moderately Hard	Can be scratched with fingernail.
Soft	Can be easily dented but not molded with fingers.

Sandstone and Conglomerate:

Well Cemented	Capable of scratching a knife blade.
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests					Soil Classification	
					Group Symbol	Group Name
Coarse - Grained Soils more than 50% retained on No. 200 sieve	Gravels more than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines	Cu≥4 and 1<Cc≤3[E]		GW	Well-graded gravel [F]
			Cu<4 and/or 1>Cc>3[E]		GP	Poorly-graded gravel [F]
		Gravels with Fines more than 12% fines	Fines classify as ML or MH		GM	Silty gravel [G,H]
			Fines Classify as CL or CH		GC	Clayey Gravel [F,G,H]
	Sands 50% or more coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines	Cu≥6 and 1<Cc≤3[E]		SW	Well-graded sand [I]
			Cu<6 and/or 1>Cc>3[E]		SP	Poorly-graded sand [I]
		Sands with Fines more than 12% fines	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid Limit less than 50	inorganic	PI>7 and plots on or above "A" Line		CL	Lean clay [K,L,M]
			PI<4 or plots below "A" Line		ML	Silt [K,L,M]
		organic	Liquid Limit - oven dried / Liquid Limit - not dried	<0.75	OL	Organic clay [K,L,M,N] / Organic silt [K,L,M,O]
	Silts and Clays Liquid Limit 50 or more	inorganic	PI plots on or above "A" Line		CH	Fat clay [K,L,M]
			PI plots below "A" Line		MH	Elastic Silt [K,L,M]
		organic	Liquid Limit - oven dried / Liquid Limit - not dried	<0.75	OH	Organic clay [K,L,M,P] / Organic silt [K,L,M,O]
Highly organic soils		Primarily organic matter, dark in color, and organic odor			PT	Peat

[A]Based on the material passing the 3-in. (75-mm) sieve

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines required dual symbols:
GW-GM well graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly-graded gravel with silt
GP-GC poorly-graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu=D_{60}/D_{10}$ $Cc=\frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to

[G]If fines classify as CL-ML, use dual symbol GC-CM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name

[I]If soil contains >15% gravel, add "with gravel" to group name

[J]If Atterberg limits plots shaded area, soil is a CL-ML, Silty clay

[K]if soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

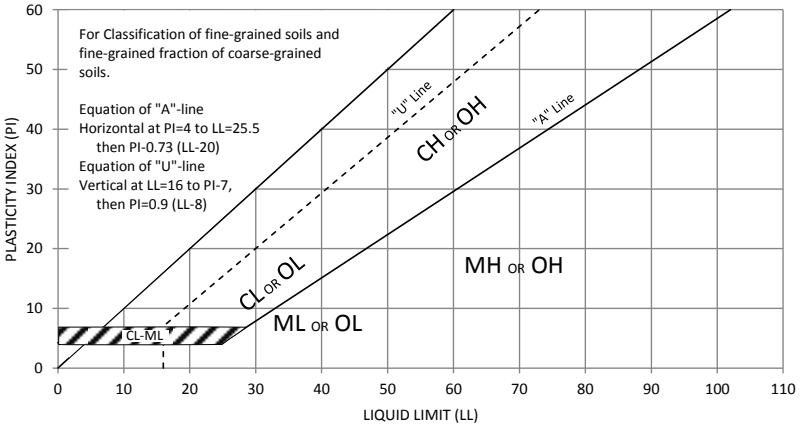
[M]If soil contains ≥30% plus No. 200 predominantly gravel, add "gravelly" to group name.

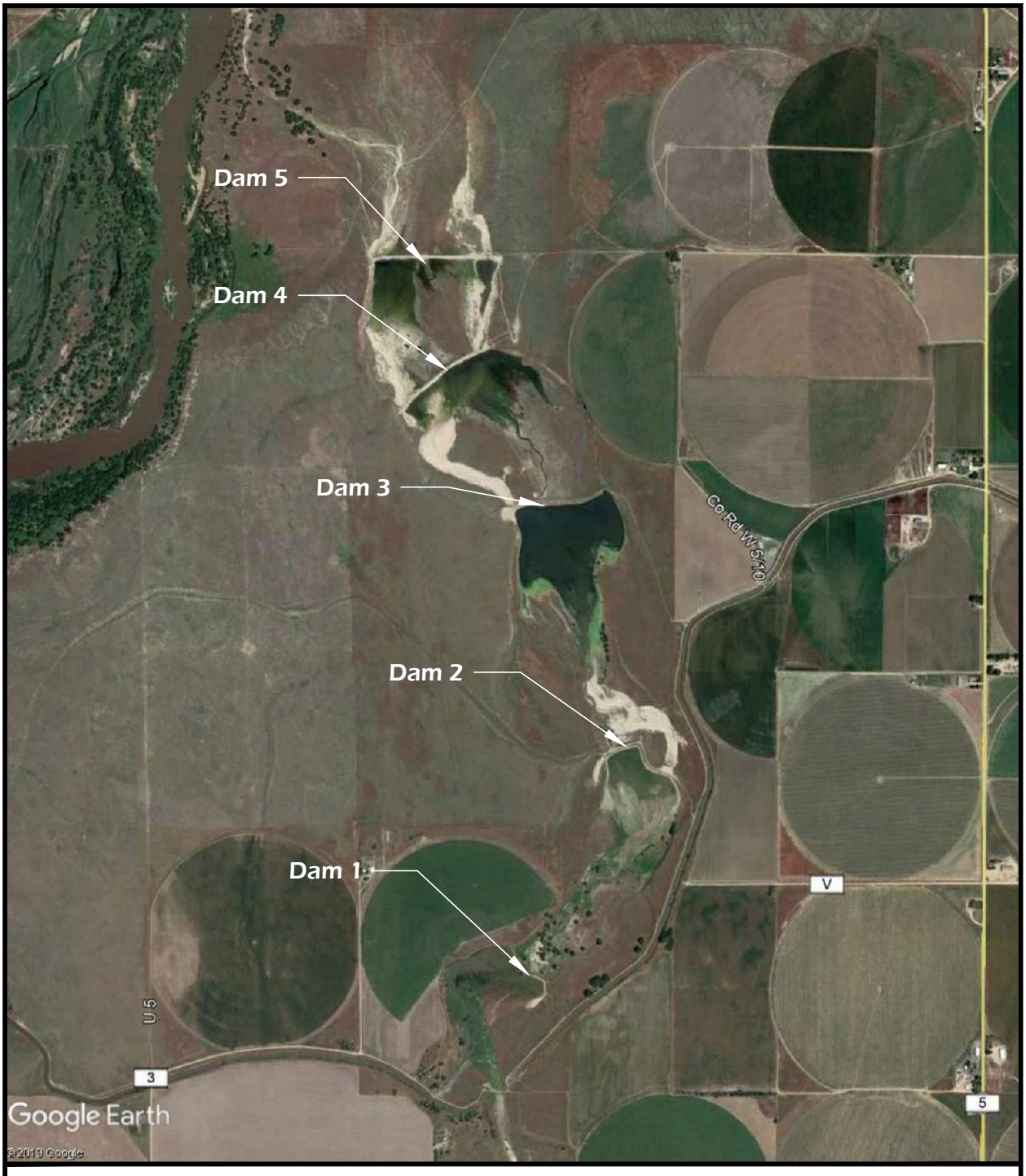
[N]PI≥4 and plots on or above "A" line.

[O]PI≤4 or plots below "A" line.

[P]PI plots on or above "A" line.

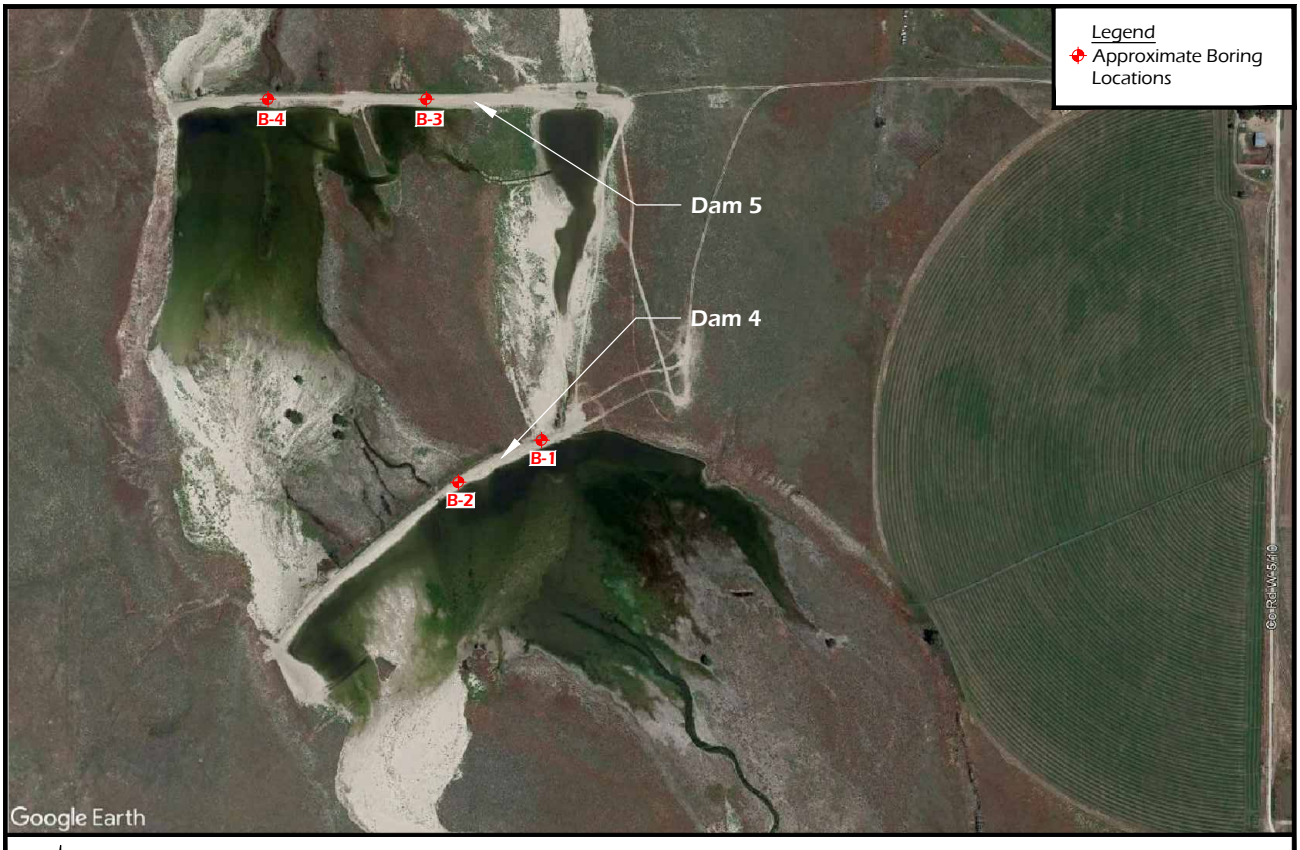
[Q]PI plots below "A" line.





North
Not to Scale

Figure 1: Site Diagram
Kiowa Recharge - Fort Morgan, Colorado
EEC Project #: 3202001
January 2020



North
Not to Scale

Figure 2: Boring Location Diagram
Kiowa Recharge - Morgan County, Colorado
EEC Project #: 3202001
March 2020

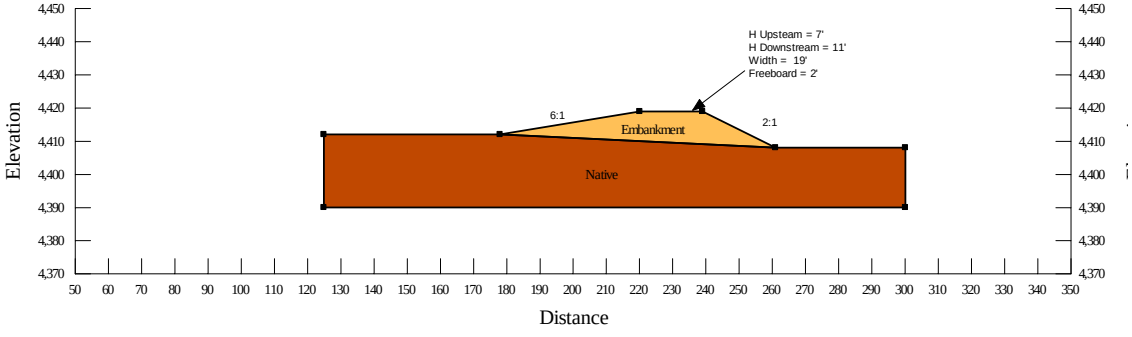


Figure 3: Existing Section – Typical Geometry.

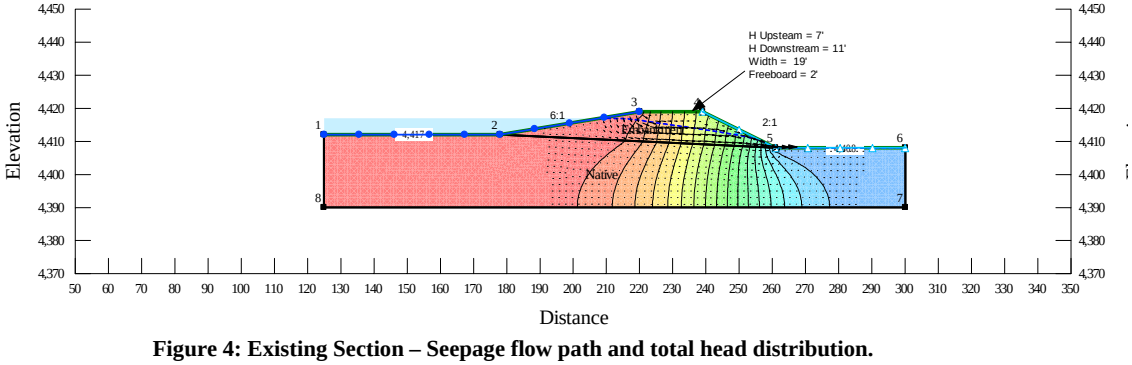


Figure 4: Existing Section – Seepage flow path and total head distribution.

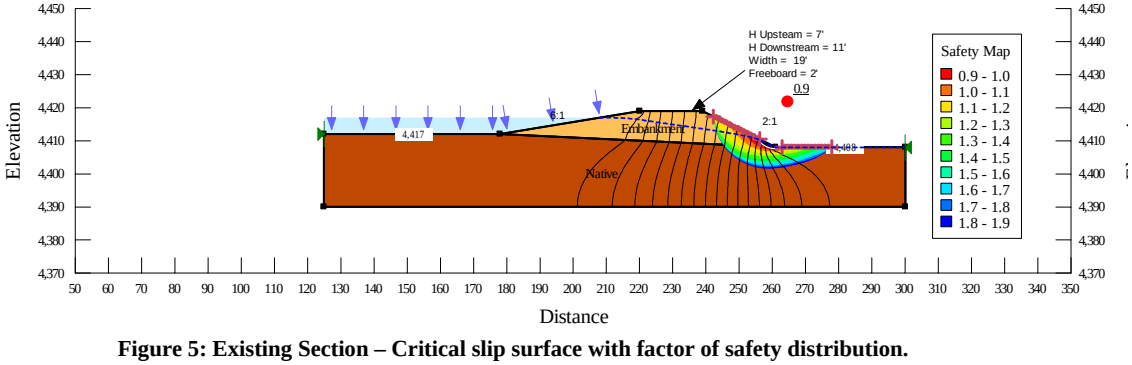


Figure 5: Existing Section – Critical slip surface with factor of safety distribution.

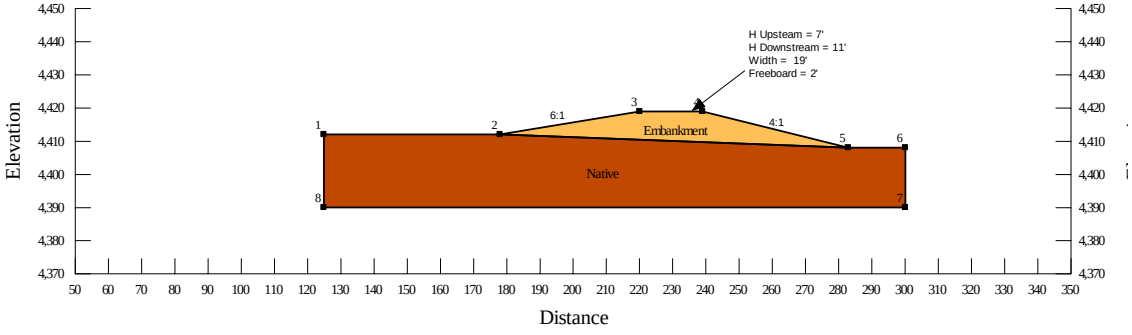


Figure 6: Improved Section – Typical Geometry.

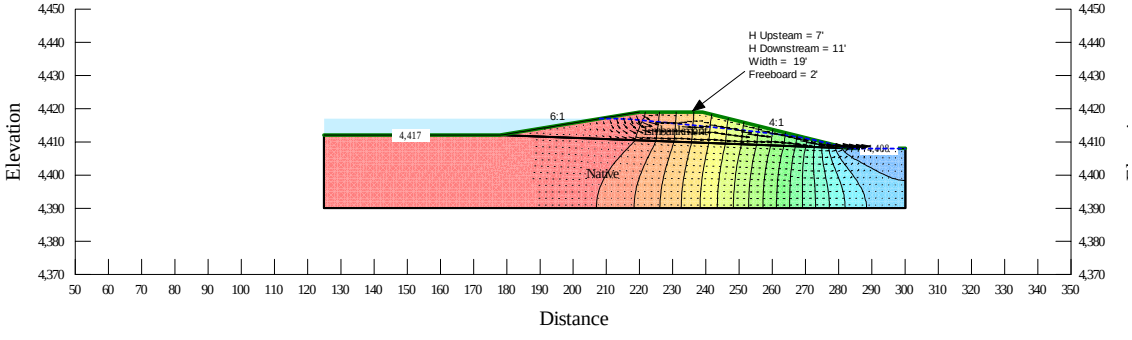


Figure 7: Improved Section – Seepage flow path and total head distribution.

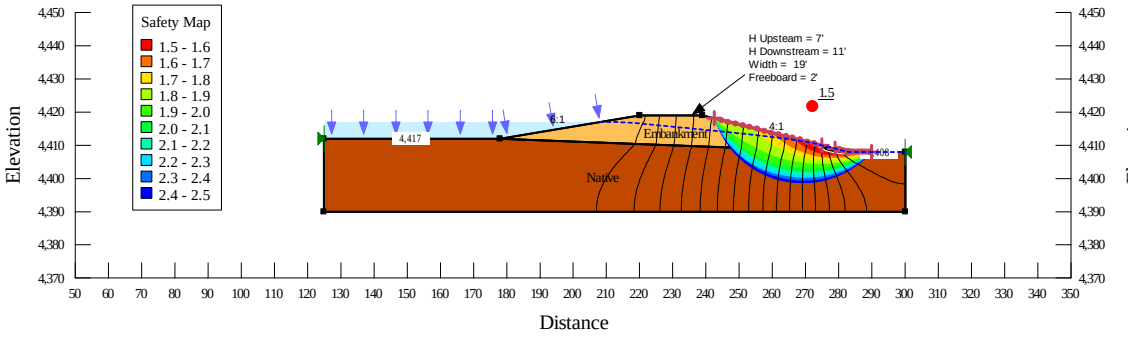


Figure 8: Improved Section – Critical slip surface with factor of safety distribution.

Photo 1: Dam #4 at Breach

Photo 2: Dam #4 at Breach

Photo 3: Dam #4 below breach showing displaced outlet pipe downstream

Photo 4: Dam #5 at breach

KIOWA RECHARGE

MORGAN COUNTY, COLORADO

PROJECT NO: 3202001	**LOG OF BORING B-1**		**DATE: MARCH 2020**
RIG TYPE: CME55	*SHEET 1 OF 1*		**WATER DEPTH**
FOREMAN: DG	**START DATE**	**2/25/2020**	**WHILE DRILLING** **24.5'**
AUGER TYPE: 4-1/4" HSA	**FINISH DATE**	**2/25/2020**	
SPT HAMMER: AUTOMATIC	**SURFACE ELEV**	**N/A**	

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
POORLY GRADED SAND with SILT (SP-SM) - Fill dark brown medium dense		1									
		2									
		3									
		4									
	SS	**5**	**15**		**8.2**						
		6									
		7									
		8									
		9									
	CS	**10**	**16**		**17.7**	**97.1**	**21**	**2**	**5.8**		
		11									
		12									
POORLY GRADED SAND (SP) brown loose to medium dense		13									
		14									
	SS	**15**	**8**		**5.6**		**NL**	**NP**	**3.3**		
		16									
		17									
		18									
		19									
	CS	**20**	**24**		**4.2**	**111.5**					
		21									
		22									
		23									
		24									
	SS	**25**	**29**		**11.9**						

Continued on Sheet 2 of 2

KIOWA RECHARGE

MORGAN COUNTY, COLORADO

PROJECT NO: 3202001	LOG OF BORING B-1			DATE: MARCH 2020						
RIG TYPE: CME55	*SHEET 2 OF 2*			WATER DEPTH						
FOREMAN: DG	START DATE		2/25/2020	WHILE DRILLING				24.5'		
AUGER TYPE: 4-1/4" HSA	FINISH DATE		2/25/2020							
SPT HAMMER: AUTOMATIC	SURFACE ELEV		N/A							

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
Continued from Sheet 1 of 2		26									
		27									
POORLY GRADED SAND (SP)											
brown		28									
medium dense											
		29									
	CS	**30**	**17**								
BOTTOM OF BORING DEPTH 30.0'		31									
		32									
		33									
		34									
		35									
		36									
		37									
		38									
		39									
		40									
		41									
		42									
		43									
		44									
		45									
		46									
		47									
		48									
		49									
		50									

Earth Engineering Consultants, LLC

KIOWA RECHARGE

MORGAN COUNTY, COLORADO

PROJECT NO: 3202001	**LOG OF BORING B-2**		**DATE: MARCH 2020**
RIG TYPE: CME55	*SHEET 1 OF 1*		**WATER DEPTH**
FOREMAN: DG	**START DATE**	**2/25/2020**	**WHILE DRILLING** **None**
AUGER TYPE: 4-1/4" HSA	**FINISH DATE**	**2/25/2020**	
SPT HAMMER: AUTOMATIC	**SURFACE ELEV**	**N/A**	

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
POORLY GRADED SAND with SILT (SP-SM) - Fill dark brown medium dense		1 2 3 4									
	CS	**5**	**24**		**6.2**	**108.3**	**NL**	**NP**	**7.5**		
		6 7									
POORLY GRADED SAND (SP) brown medium dense to dense with various amounts of silt		8 9									
	SS	**10**	**38**		**3.6**						
		11 12 13 14									
	CS	**15**	**14**		**15.6**	**105.5**					
		16 17 18 19									
	SS	**20**	**25**		**4.3**		**NL**	**NP**	**7.3**		
		21 22 23 24									
	CS	**25**	**39**		**3.6**	**115.3**					

Continued on Sheet 2 of 2

Earth Engineering Consultants, LLC

KIOWA RECHARGE

MORGAN COUNTY, COLORADO

PROJECT NO: 3202001	LOG OF BORING B-2			DATE: MARCH 2020						
RIG TYPE: CME55	*SHEET 2 OF 2*			WATER DEPTH						
FOREMAN: DG	START DATE		2/25/2020	WHILE DRILLING				None		
AUGER TYPE: 4-1/4" HSA	FINISH DATE		2/25/2020							
SPT HAMMER: AUTOMATIC	SURFACE ELEV		N/A							

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
Continued from Sheet 1 of 2		26									
		27									
POORLY GRADED SAND (SP)											
brown		28									
dense											
		29									
	SS	**30**	**36**		**13.8**						
BOTTOM OF BORING DEPTH 30.5'		31									
		32									
		33									
		34									
		35									
		36									
		37									
		38									
		39									
		40									
		41									
		42									
		43									
		44									
		45									
		46									
		47									
		48									
		49									
		50									

KIOWA RECHARGE

MORGAN COUNTY, COLORADO

PROJECT NO: 3202001		**LOG OF BORING B-3**				**DATE: MARCH 2020**				
RIG TYPE: CME55		*SHEET 1 OF 2*				**WATER DEPTH**				
FOREMAN: DG		**START DATE**		**2/25/2020**		**WHILE DRILLING**			**25'**	
AUGER TYPE: 4-1/4" HSA		**FINISH DATE**		**2/25/2020**						
SPT HAMMER: AUTOMATIC		**SURFACE ELEV**		**N/A**						
SOIL DESCRIPTION		**D**	**N**	**QU**	**MC**	**DD**	**A-LIMITS**		**-200**	**SWELL**
	TYPE	**(FEET)**	**(BLOWS/FT)**	**(PSF)**	**(%)**	**(PCF)**	**LL**	**PI**	**(%)**	**PRESSURE**	**% @ 500 PSF**
POORLY GRADED SAND with SILT (SP-SM) - Fill		1									
dark brown		2									
medium dense		3									
		4									
with trace clayey lense	CS	**5**	**16**		**9.7**	**108.1**	**27**	**12**	**10.2**		
		6									
		7									
POORLY GRADED SAND (SP)		8									
brown		9									
medium dense	SS	**10**	**12**		**6.1**		**NL**	**NP**	**2.2**		
		11									
		12									
		13									
		14									
	CS	**15**	**12**		**7.0**	**101.6**					
		16									
		17									
		18									
		19									
	SS	**20**	**25**		**5.6**						
		21									
		22									
		23									
		24									
with trace clayey lense	CS	**25**	**17**	**1500**	**16.8**	**105.0**					

Continued on Sheet 2 of 2

KIOWA RECHARGE

MORGAN COUNTY, COLORADO

PROJECT NO: 3202001	LOG OF BORING B-3			DATE: MARCH 2020						
RIG TYPE: CME55	*SHEET 2 OF 2*			WATER DEPTH						
FOREMAN: DG	START DATE		2/25/2020	WHILE DRILLING				25'		
AUGER TYPE: 4-1/4" HSA	FINISH DATE		2/25/2020							
SPT HAMMER: AUTOMATIC	SURFACE ELEV		N/A							

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
Continued from Sheet 1 of 2		26									
POORLY GRADED SAND (SP)		27									
brown											
medium dense		28									
		29									
	SS	**30**	**16**	**--**	**17.0**						
BOTTOM OF BORING DEPTH 30.5'		31									
		32									
		33									
		34									
		35									
		36									
		37									
		38									
		39									
		40									
		41									
		42									
		43									
		44									
		45									
		46									
		47									
		48									
		49									
		50									

KIOWA RECHARGE

MORGAN COUNTY, COLORADO

PROJECT NO: 3202001	**LOG OF BORING B-4**		**DATE: MARCH 2020**
RIG TYPE: CME55	*SHEET 1 OF 2*		**WATER DEPTH**
FOREMAN: DG	**START DATE**	**2/25/2020**	**WHILE DRILLING** **25'**
AUGER TYPE: 4-1/4" HSA	**FINISH DATE**	**2/25/2020**	
SPT HAMMER: AUTOMATIC	**SURFACE ELEV**	**N/A**	

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
POORLY GRADED SAND with SILT (SP-SM) - Fill		1									
dark brown		2									
medium dense		3									
		4									
	SS	**5**	**24**		**5.0**		**NL**	**NP**	**6.9**		
		6									
		7									
POORLY GRADED SAND (SP)		8									
brown		9									
medium dense to dense											
	CS	**10**	**33**		**3.6**	**105.7**					
		11									
		12									
		13									
		14									
well graded zone	SS	**15**	**18**		**8.0**		**NL**	**NP**	**4.3**		
		16									
		17									
		18									
		19									
with trace clayey lenses	CS	**20**	**16**		**7.6**	**96.3**					
		21									
		22									
		23									
		24									
	SS	**25**	**27**	**500**	**17.8**						

Continued on Sheet 2 of 2

KIOWA RECHARGE

MORGAN COUNTY, COLORADO

PROJECT NO: 3202001		**LOG OF BORING B-4**				**DATE: MARCH 2020**					
RIG TYPE: CME55		*SHEET 2 OF 2*				**WATER DEPTH**					
FOREMAN: DG		**START DATE**		**2/25/2020**		**WHILE DRILLING**			**25'**		
AUGER TYPE: 4-1/4" HSA		**FINISH DATE**		**2/25/2020**							
SPT HAMMER: AUTOMATIC		**SURFACE ELEV**		**N/A**							
SOIL DESCRIPTION		**D**	**N**	**QU**	**MC**	**DD**	**A-LIMITS**		**-200**	**SWELL**	
	TYPE	**(FEET)**	**(BLOWS/FT)**	**(PSF)**	**(%)**	**(PCF)**	**LL**	**PI**	**(%)**	**PRESSURE**	**% @ 500 PSF**
Continued from Sheet 1 of 2		26									
POORLY GRADED SAND (SP)		27									
brown											
medium dense		28									
		29									
	CS	**30**	**26**		**15.0**	**114.0**					
BOTTOM OF BORING DEPTH 30.0'		31									
		32									
		33									
		34									
		35									
		36									
		37									
		38									
		39									
		40									
		41									
		42									
		43									
		44									
		45									
		46									
		47									
		48									
		49									
		50									

EARTH ENGINEERING CONSULTANTS, LLC

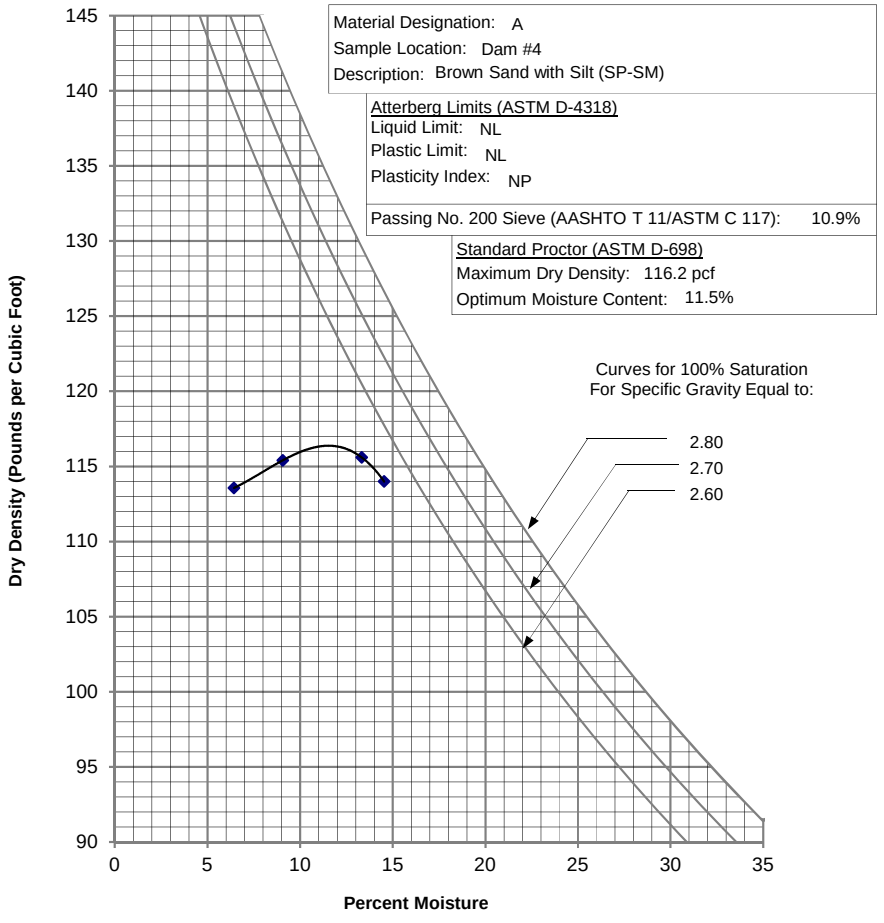
SUMMARY OF LABORATORY CLASSIFICATION

Project:	Kiowa Recharge	**Project No.:**	3202001
Location:	Morgan County, Colorado	**Date**	March 2020

Sieve No.	Washed Sieve Analysis (ASTM Specifications C117 and C136)							
	B-1, S-2, 9'	**B-1, S-3, 14'**	**B-2, S-1, 4'**	**B-2, S-4, 19'**	**B-3, S-1, 4'**	**B-3, S-2, 9'**	**B-4, S-1, 4'**	**B-4, S-3, 14'**
3"	100	100	100	100	100	100	100	100
2"	100	100	100	100	100	100	100	100
1 1/2"	100	100	100	100	100	100	100	100
1"	100	100	100	100	100	100	100	100
3/4"	100	100	100	100	100	100	100	100
1/2"	100	100	100	100	100	100	100	100
3/8"	100	100	100	100	100	100	100	100
No. 4	100	100	100	100	100	100	100	100
No. 8	99	100	100	94	100	99	98	96
No. 10	99	100	100	91	100	98	97	94
No. 16	96	98	99	75	99	91	91	80
No. 30	71	89	88	51	92	58	75	47
No. 40	55	76	76	40	82	38	61	29
No. 50	38	52	55	28	64	21	41	23
No. 100	14	10	19	13	26	5	14	17
No. 200	5.8	3.3	7.5	7.3	10.2	2.2	6.9	4.3
Atterberg Limits (ASTM Specification D4318)								
Liquid Limit	21	NL	NL	NL	27	NL	NL	NL
Plastic Limit	19	NL	NL	NL	15	NL	NL	NL
Plasticity Index	2	NP	NP	NP	12	NP	NP	NP
USCS	SP-SM	SP	SP-SM	SP-SM	SP-SC	SP	SP-SM	SW

EARTH ENGINEERING CONSULTANTS, LLC

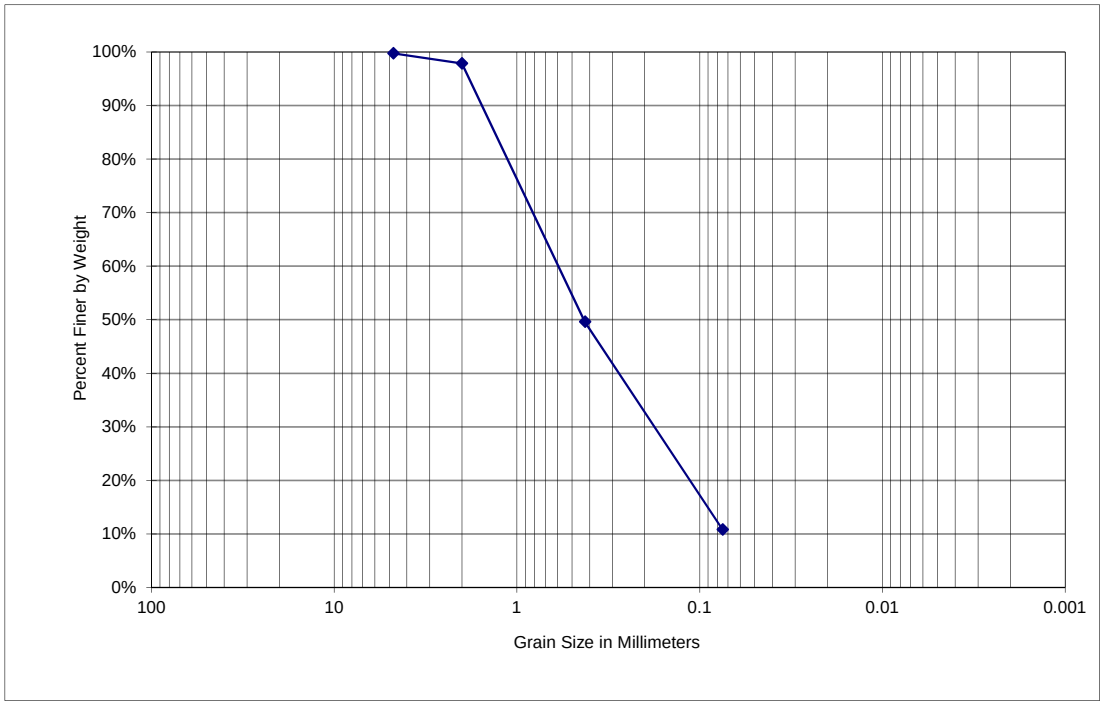
SUMMARY OF LABORATORY CLASSIFICATION/MOISTURE-DENSITY RELATIONSHIP



Project: Kiowa Recharge
Morgan County, Colorado
Project No: 3202001
Date March 2020

EARTH ENGINEERING CONSULTANTS, LLC

SUMMARY OF LABORATORY CLASSIFICATION / MOISTURE-DENSITY RELATIONSHIP



Sieve Size	Percent Passing
No. 4	100%
No. 10	98%
No. 40	50%
No. 200	10.9%

Material Designation: A
Sample Location: Dam #4
Material Description: Brown Sand with Silt (SP-SM)

Project: Kiowa Recharge
Morgan County, Colorado
Project No: 3202001
Date March 2020

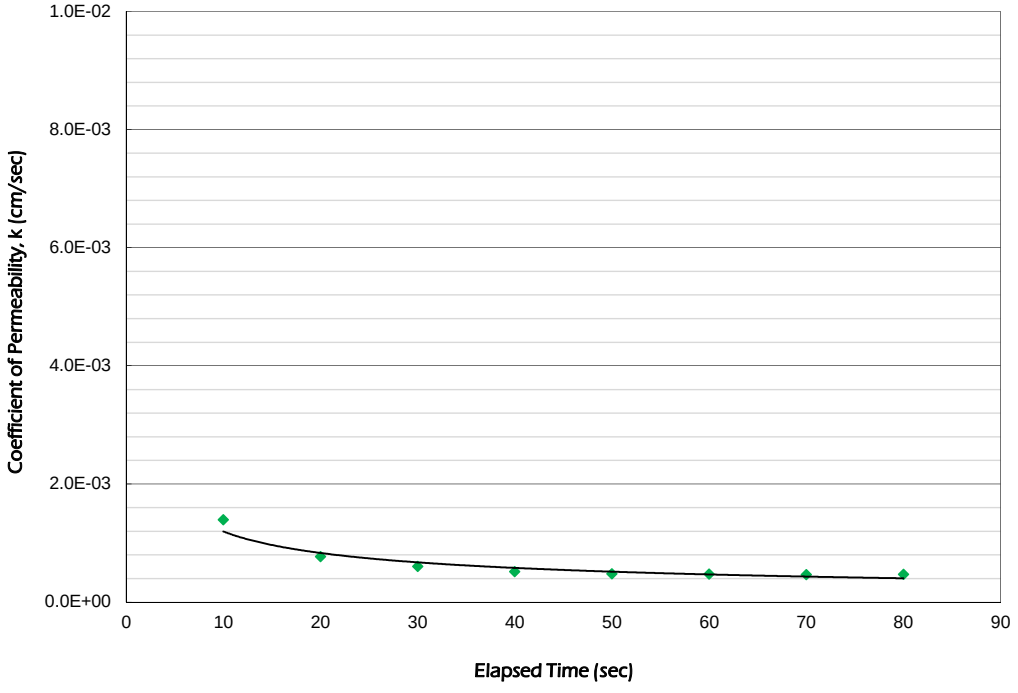
EARTH ENGINEERING CONSULTANTS, LLC

Permeability Test Results (ASTM D5856)

Kiowa Recharge - Morgan County, Colorado

Sample:	A - Dam #4				
Material Description:	Brown Sand with Silt (SP-SM)				
Liquid Limit:	NL	Plasticity Index:	NP	% Passing #200:	10.9
Initial Moisture:	15.0%	Dry Density:	105.0 pcf	Final Moisture:	16.1%

Coefficient of Permeability, k = 4.69 x 10^{-4} cm/s



Project Name: Kiowa Recharge

Location: Morgan County, Colorado

Project Number: 3202001

Date: March 2020

EARTH ENGINEERING CONSULTANTS, LLC

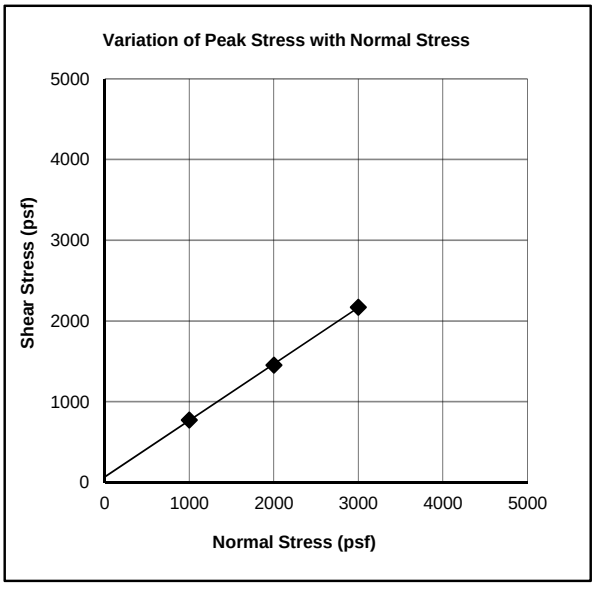
DIRECT SHEAR TEST REPORT

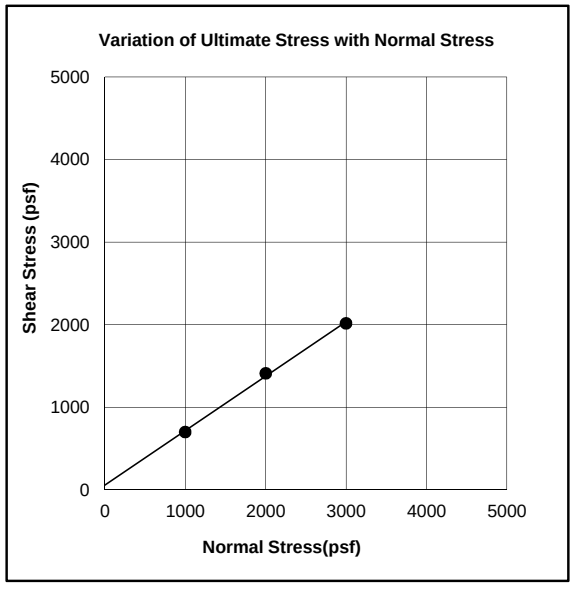
ASTM D3080

CLIENT: CCWCD
PROJECT: Kiowa Recharge
PROJECT NO. 3202001
SAMPLE LOCATION: A - Dam #4 (Composite Sample)
SOIL CLASSIFICATION: Brown Sand with Silt (SP-SM) - Remolded

SAMPLE NO.	NORMAL STRESS (PSF)	ULTIMATE SHEAR STRESS (PSF)	PEAK SHEAR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
1	1000	700	773	2.1	84.1
2	2000	1410	1454	2.7	83.6
3	3000	2017	2172	2.4	83.9

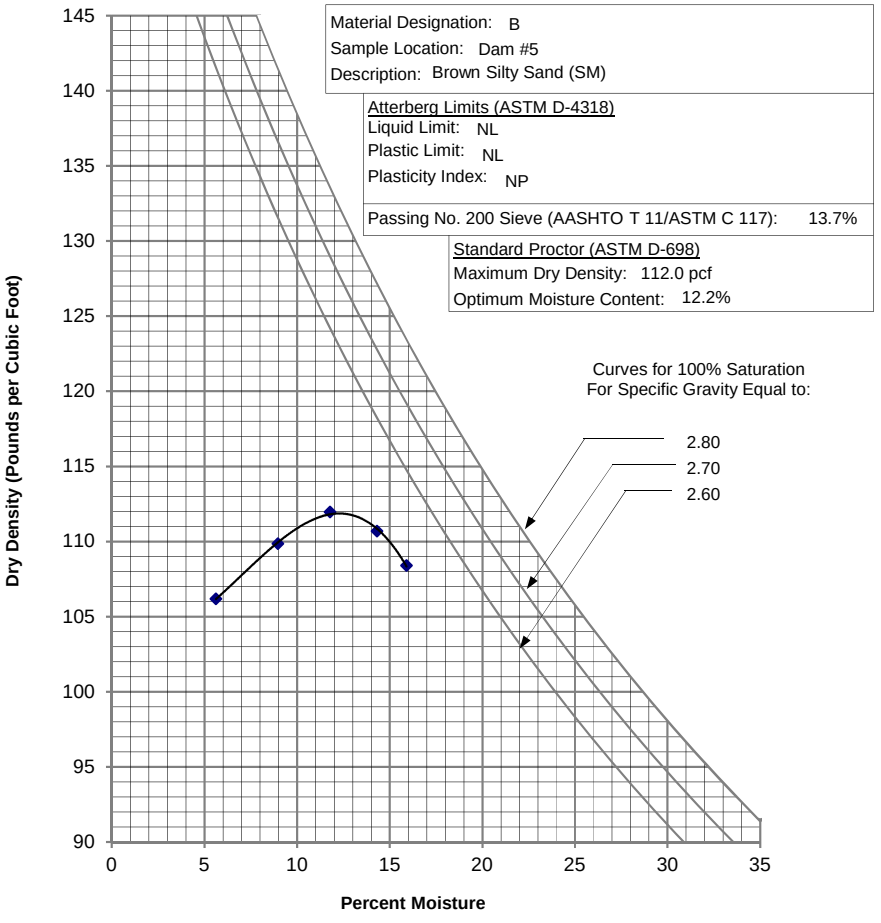
	FRICTION ANGLE (ϕ)	COHESION (psf)
PEAK	35.0	68
ULTIMATE	33.4	58





EARTH ENGINEERING CONSULTANTS, LLC

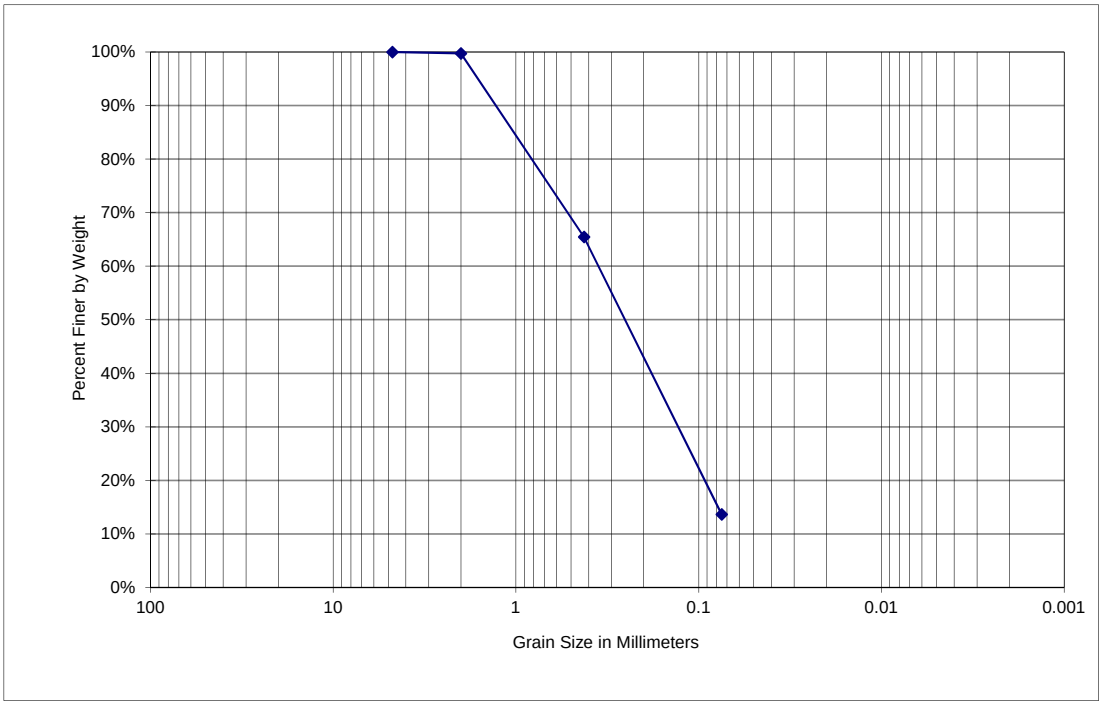
SUMMARY OF LABORATORY CLASSIFICATION/MOISTURE-DENSITY RELATIONSHIP



Project: Kiowa Recharge
Morgan County, Colorado
Project No: 3202001
Date March 2020

EARTH ENGINEERING CONSULTANTS, LLC

SUMMARY OF LABORATORY CLASSIFICATION / MOISTURE-DENSITY RELATIONSHIP



Sieve Size	Percent Passing
No. 4	100%
No. 10	100%
No. 40	65%
No. 200	13.7%

Material Designation: B
Sample Location: Dam #5
Material Description: Brown Silty Sand (SM)

Project: Kiowa Recharge
Morgan County, Colorado
Project No: 3202001
Date March 2020

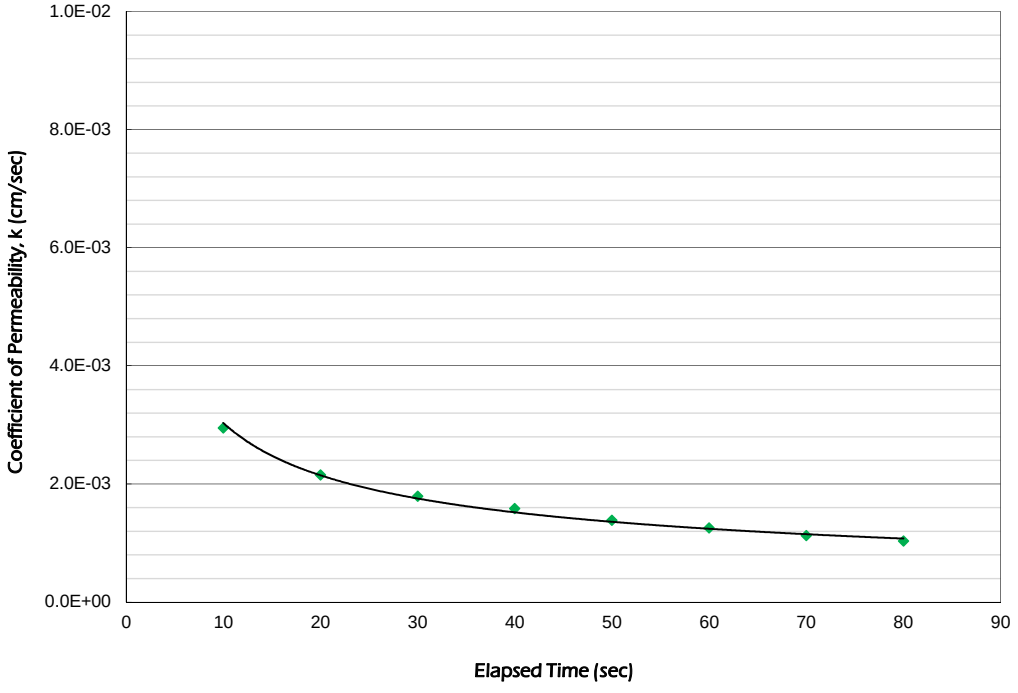
EARTH ENGINEERING CONSULTANTS, LLC

Permeability Test Results (ASTM D5856)

Kiowa Recharege - Morgan County, Colorado

Sample:	B - Dam #5				
Material Description:	Brown Silty Sand (SM)				
Liquid Limit:	NL	Plasticity Index:	NP	% Passing #200:	13.7
Initial Moisture:	17.0%	Dry Density:	100.1 pcf	Final Moisture:	19.7%

Coefficient of Permeability, k = 1.14 x 10^{-3} cm/s



Project Name: Kiowa Recharege

Location: Morgan County, Colorado

Project Number: 3202001

Date: March 2020

EARTH ENGINEERING CONSULTANTS, LLC

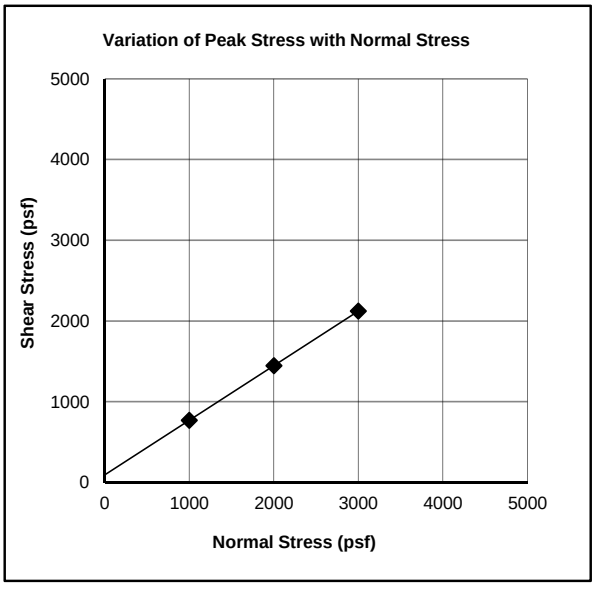
DIRECT SHEAR TEST REPORT

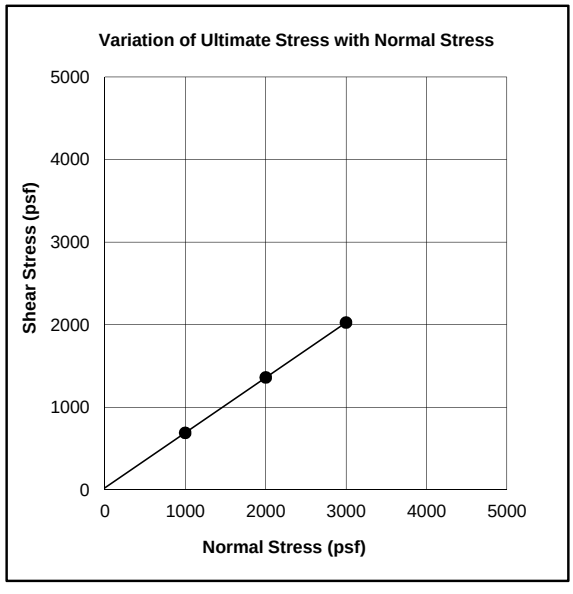
ASTM D3080

CLIENT: CCWCD
PROJECT: Kiowa Recharge
PROJECT NO. 3202001
SAMPLE LOCATION: B - Dam #5 (Composite Sample)
SOIL CLASSIFICATION: Brown Silty Sand (SM) - Remolded

SAMPLE NO.	NORMAL STRESS (PSF)	ULTIMATE SHEAR STRESS (PSF)	PEAK SHEAR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
1	1000	691	769	4.0	84.0
2	2000	1362	1446	3.9	84.0
3	3000	2026	2121	4.0	84.0

	FRICTION ANGLE (ϕ)	COHESION (psf)
PEAK	34.1	93
ULTIMATE	33.7	25





7.5 OWW Finacial Documents

ARTICLES OF ORGANIZATION
Form 400 Revised July 1, 2002
Filing fee: **$50.00**
Deliver to: Colorado Secretary of State
Business Division,
1560 Broadway, Suite 200
Denver, CO 80202-5169
This document must be typed or machine printed
Copies of filed documents may be obtained at www.sos.state.co.us

FILED
DONETTA DAVIDSON
COLORADO SECRETARY OF STATE

20031303115 C
$ 100.00
SECRETARY OF STATE
09-22-2003 12:23:32

ABOVE SPACE FOR OFFICE USE ONLY

Pursuant to § 7-80-203, Colorado Revised Statutes (C.R.S.), the individual named below causes these Articles of Organization to be delivered to the Colorado Secretary of State for filing, and states as follows:

1. The name of the limited liability company is: Orphan and Widow Wells a/k/a OWW, L.L.C.

The name of a limited liability company must contain the term "limited liability company", "ltd. liability company", "limited liability co.", or "ltd. liability co." or the abbreviation "LLC" or "L.L.C." §7-90-601(3)[(e), C.R.S.

2. *If known,* The principal place of business of the limited liability company is: 3506 County Road "T", Wiggins, Colorado 80654

3. The name, and the business address, of the registered agent for service of process on the limited liability company are: Name Steven Duane Bruntz,
Business Address *(must be a street or other physical address in Colorado)* 3506 County Road "T", Wiggins, Colorado 80654
If mail is undeliverable to this address, ALSO include a post office box address:

4. a. *If the management of the limited liability company is vested in managers, mark the box*
☑ "The management of the limited liability company is vested in managers rather than members."
The name(s) and business address(es) of the initial manager(s) is(are):
Name(s) Steven Duane Bruntz Business Address(es) 3506 County Road "T", Wiggins, Colorado 80654; Alan Axton, 3506 County Road "T", Wiggins, Colorado 80654

OR

b. *If management of the limited liability company is not vested in managers rather than members,*
The name(s) and business address(es) of the initial member(s) is(are):
Name(s) Business Address(es)

5. The (a) name or names, and (b) mailing address or addresses, of any one or more of the individuals who cause this document to be delivered for filing, and to whom the Secretary of State may deliver notice if filing of this document is refused, are: Bradley D. Laue, Esq., Brega & Winters P.C., 5754 West 11th Street, Suite #101, Greeley, Colorado 80634-4811

OPTIONAL. The electronic mail and/or Internet address for this entity is/are: e-mail
Web site
The Colorado Secretary of State may contact the following authorized person regarding this document:
name address
voice fax e-mail

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