BUREAU OF RECLAMATION

Algae Resistant Linings for Canals and Other Water Resource Structures

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Research and Development Office
Final Report No. ST-2019-PROJECT ID 19242-REPORT NUMBER 01
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14. ABSTRACT
Reclamation and QCBID teamed together to test various integral concrete admixtures and topically applied sealer to test their effectiveness at mitigating algae growth. Concrete panels were tested over two irrigation seasons. The integral products trialed did not appear to mitigate algae growth. The topically applied products appeared to have an effect on algae growth but should be tested on in-service full-size panels over multiple season.

15. SUBJECT TERMS
Algae, canal concrete, algae resistant concrete

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			Jeffery (Scott) Keim

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Bureau of Reclamation
Research and Development Office
Science and Technology Program

Final Report ST-2019-Project ID 19242- Report Number 01

Algae Resistant Linings for Canals and Other Water Structures

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Acronyms and Abbreviations

CSL	Reclamation Concrete and Structural Laboratory Group
DOE	Washington State Department of Ecology
O&M	Operations and Maintenance
psi	pounds per square inch
QCBID	Quincy-Columbia Basin Irrigation District
Reclamation	Bureau of Reclamation
TSC	Technical Service Center

Table of Contents

Page

Table of Figures

Executive Summary

The Bureau of Reclamation's (Reclamation) Concrete and Structural Laboratory (CSL) and the Quincy-Columbia Basin Irrigation District, Quincy (QCBID), WA partnered to evaluate algae resistant canal concrete alternatives. This research effort aimed to better understand chemical and physical characteristics of concrete and concrete surfaces that would inhibit algae growth on canal linings and other water resource structures by evaluating various changes to the concrete canal system.

Every year, irrigation districts treat their canals with 140,000 pounds of copper sulfate to reduce the algae that stick to the canal sides and reduce the flow of water, thus slowing down deliveries and causing other operation issues.

After discussions with QCBID and concrete admixture manufacturers, it was decided to trial several integral products as well as a topical product and a smoother finish technique. Eight concrete panels were cast in February 2020 at the QCBID maintenance yard in Quincy, Washington. Panels were placed into a QCBID canal in April 2020.

A second round of panels were cast in March 2021 at the QCBID maintenance yard using only topically applied products. Due to COVID restrictions, Reclamation personnel were not able to be present for the casting of panels in 2021. Panels were placed into a QCBID canal in April 2021.

During both trials, the panels were observed and photographed monthly. During the 2020 irrigation season, algae formed on all panels. One panel that was treated with a commercially available sealer showed delayed formation of algae but, by the end of the irrigation season, all panels appeared to have an equal amount of algae build-up. The panels placed in the canal in 2021 showed much less algae growth than the 2020 panels. It was noticed that lichen had formed on the panels and some algae but not to the level of the 2020 trials. It was stated by QCBID that the 2021 irrigation season was a different season than 2020 in the fact that there was also less algae growth on the main canal.

Based on the reduced algae growth on the panels with topically applied products, further testing should be considered using the same products as trialed in 2021. Future proposals should reference a Technology Readiness Level TRL 6, *engineering-scale models or protypes tested in a relevant environment.* This can be accomplished on in-service full concrete canal panels that can be monitored and tested over time.

Admixture and sealer manufacturers should be further engaged so they are aware of the issue and may begin some research work on finding a product that can mitigate the development of algae blooms in canals. This concept should also be evaluated to determine if it would be a good fit for a Reclamation Research and Development Prize Competition.

1. Introduction

1.1 Project Background

Aquatic algae and mosses are prolific in western irrigation systems and cause significant operation and maintenance challenges; restricting the flow of water in canals and reducing canal carrying capacity, impairing transport pumps, and disrupting on-farm water deliveries. The presence of invasive aquatic macrophytes (including algae and mosses) is growing which leads to increasing water surface elevations in canals which can also pose a safety risk to neighboring lands and increasing operational risk. Reclamation has over 39,100 miles of canals and laterals in which hundreds of thousands of pounds of pesticides containing copper, acrolein, endothall, xylene, and others are used each year to control algae.

The Bureau of Reclamation's (Reclamation) Concrete and Structural Laboratory (CSL) was contacted by the Quincy-Columbia Basin Irrigation District (QCBID), Quincy, WA who was interested in looking at algae resistant canal concrete alternatives. Every year, irrigation districts treat their canals with 140,000 pounds of copper sulfate to reduce the algae that stick to the canal sides and reduce the flow of water, thus slowing down deliveries and causing other operation issues. The aquatic chemicals used by QCBID are based on a permit by DOE and are deemed safe to use for crops. With the permit, QCBID has compliance sites where they must assure that treated water is not above the maximum concentration level based on the chemical used. Organic water-users are not able to use water treated with acrolein or endothall products. When the canals are treated with those products, they have to turn their water off until that chemical slug passes through. The copper sulfate that QCBID uses is certified organic.

1.2 History

Irrigations Districts spend millions of dollars each year controlling aquatic weeds and algae in canals. The Quincy-Columbia Basin Irrigation District alone spends over 1 million dollars annually. Other methods include biological and mechanical, but these methods of control are costly and inefficient. There are currently no known practical alternatives to using herbicides. The Quincy-Columbia Basin Irrigation District spends over $200,000 a year to replace ageing concrete infrastructure, including concrete canal lining panels, and a new concrete composite could be included into current operations and maintenance (O&M) programs.

Reclamation owns more than 39,100 miles of canals and laterals that serve water to 10 million acres of farmland. As ageing infrastructure, such as canals are replaced and when new sections of earthen canals are lined for water conservation and safety, algae resistant concrete could be applied. The benefits include less environmental risk from using pesticides, lower operational risk /safety risk by stopping the increasing water surface elevations, lower operation and maintenance costs for removing the algae, and improved reliability of water deliveries.

There is increased pressure to reduce the use of aquatic pesticides such as those containing copper due to toxicity concerns toward endangered salmon and other aquatic life at low concentrations. In

Washington State, for example, regulators promulgated regulation that banned copper in boat paint, brake pads, roofing materials, and residential pesticides.

Though aquatic pesticides will remain a necessary tool for the operation and maintenance of Reclamation's facilities, algae resistant linings would provide numerous environmental and regulatory benefits such as decreased operation and maintenance cost, reductions in pesticide use, and increased system reliability.

In addition to replacing ageing infrastructure, irrigators are lining canals and laterals for water conservation and energy efficiency purposes. The Quincy-Columbia Basin Irrigation District has lined over 65 miles of canals and conserving 546 acre-feet of water over the last 13 years. As conservation projects are realized and completed, algae resistant linings would be utilized.

When in full bloom, untreated algae and mosses slow down flows and increase water surface elevations contributing to a 50% loss in water delivery capacity. They also clog turnouts and sprinklers adding to the O&M cost throughout the entire water delivery system.

2. Approach

Reclamation and QCBID partnered with biologists, coatings experts, technical representatives of concrete admixture manufacture, for this research project. A literature review was first conducted, followed by meetings with subject matter experts. After this preliminary stage, it was decided to trial several integral products as well as a topical product and a smoother finish technique. The research approach included casting concrete test panels and the placing these panel in the canal for a length of time in which they would experience the season of algae bloom. Monitoring and evaluation was primarily by visual observation.

2.1 Literature Review

A literature review was performed in 2019 and a list of literature reviewed in presented in Appendix A. Several of the articles were broad and did not provide specific guidelines. The article by Alum A, et al. recommended the use of zinc oxide for controlling algae growth. A zinc product was not trialed since it was unclear if the exposure to zinc may be detrimental to any fish. If it is determined that exposure of fish to zinc is not a concern, trialing a zinc oxide product in the future may be advisable. Another article reviewed was a related to anti-fouling agents for evasive mussels. This product may be effective for algae mitigation but it's cost may be prohibitive for wide-spread use as well as potential toxicity. It was clear that more research is needed to determine a cost-effective and reliable product for use in controlling algae growth in irrigation canals.

2.2 Biological Discussion

Reclamation biologists were consulted during the testing program development to see if there was any testing or classification of the algae that should be a part of this study. Due to the vast number of algae species and growth environments, it was decided that testing the waters or canal surfaces to obtain information on the QCBID algae or tying to replicate or grow algae in the laboratory would not be practical. Concrete pore structure was thought to be a bigger driver for algae or invasive species attachment. Water samples from the QCBID canals were obtained and results are presented in Appendix B.

The mitigation of algae growth in canals most likely will not be a one-size fits-all solution. Given the vast number of algae types and varying conditions in different parts of the country, a localized approach will most likely be needed.

2.3 2020 Study

CSL personnel contacted several concrete admixture vendors to discuss products that may be available and most clearly aligned with the testing objectives of this research. After consultation, the additives to be tested were selected by CSL staff. The selections are briefly discussed below, and their data sheets (if available) can be found in Appendix C.

1. Control Panel
2. Copper Slag Blasting Media
3. GCP Applied Technologies Darapel
4. GCP Applied Technologies Force 10,000
5. Sherwin William Loxon Self-Cleaning coating for concrete.
6. One panel was finished with a smoother finish.

Control Panel

The control panel was made from a standard concrete typical in canal operations in the Quincy-Columbia area. The concrete was finished with a steel trowel finish which results in a somewhat roughened surface. This finish type is standard for canal concrete lining.

Copper Slag Blasting Media

Copper Slag Blasting Media is a byproduct of copper separation during the smelting process. Two different sizes were trialed. Size 20/50 and 30/60 were used. They are a medium sized blasting media. The perceived benefit of using the copper slag was to introduce a form of copper that could inhibit algae growth while being able to utilize a waste product. We were interested to see if the abrasiveness of the material had any effect on concrete properties (strength, mixing, finishing.)

Darapel

Darapel is a water repelling concrete admixture produced by GCP Applied Technologies. Other concrete water repellant admixtures are commercially available and can easily be incorporated into standard concrete specification for canals with minimal cost. The reduction of water infiltration into the surface of the concrete may have an effect on the algae's ability to adhere to and grow on the concrete surface.

Force 10,000

Force 10,000 is a concrete admixture produced by GCP Applied Technologies. It is a densified microsilica (silica fume) used to increase concrete durability by making it less permeable and typically achieves higher strengths. Silica Fume is commercially available and can easily be incorporated into standard concrete specification for canals with minimal cost. Microsilica is a smaller particle than cement so it would create a tighter particle spacing. The reasoning for trialing microsilica was to test if reducing the permeability of the concrete may reduce or prevent the ability of algae to grow on the surface.

Loxon Self-Cleaning Acrylic Coating

Loxon Self-Cleaning Acrylic Coating is a coating produced by Sherwin William. It is marketed as a high-performance coating for concrete and masonry that has advanced durability, water-shedding, water repellency and dirt pick-up resistance. The Loxon was trialed because of its ability to seal the pore structure of concrete and reduce its ability to absorb moisture and repel dirt.

Copper Sulfate

The addition of copper sulfate was not originally planned. The copper sulfate used was the same product that QCBID uses in their canals. The product was added in solid form as opposed to being put into solution and then added to the base concrete mix.

Smoother Finish

One concrete panel was finished with a smoother finish. Most of the concrete panels were finished with a float finish which results in a somewhat roughened surface. This finish type is standard for canal concrete lining. The smoother finish was a steel trowel finish which took care to close up the surface more than the other panels, removing the roughness of a standard finish. It was felt that the smoother finish may make it more difficult for the algae to adhere to the panel. Care has to be taken when finishing air-entrained concrete to a smoother finish. This type of finish may cause blistering if not done correctly.

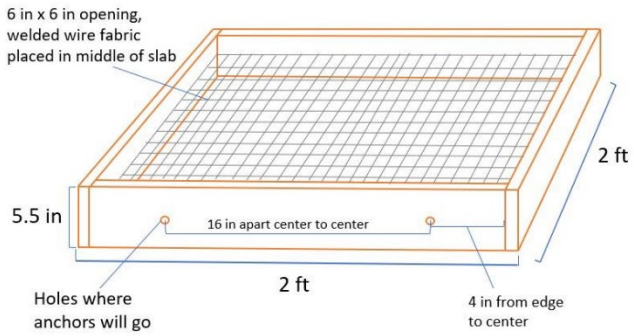
Metakaolin

Metakaolin is the anhydrous calcined form of the clay mineral kaolinite. The particle size of metakaolin is smaller than the particle size of cement. Metakaolin is a natural pozzolan that is added

to concrete to increase its durability. This material is gaining popularity as a supplementary cementitious material for use in concrete. It was planned to trial metakaolin in one of the test panels but the material did arrive in time for inclusion in the trial.

On February 13, 2020, representatives of Reclamation's Technical Service Center traveled to Quincy, Washington to fabricate eight concrete test panels. A Test Panel Concept Plan was developed by CSL with input from QCBID and included design of the test panels, field fabrication, and data collection procedures. This Test Panel Concept Plan can be found in Appendix D. The panels were designed with light reinforcement to prevent cracking and of a size and weight to prevent them from floating in the canal with the given flows.

The panel forms were fabricated by QCBID per the sketch provided by CSL (Figure 1). Completed panel forms are shown in Figure 2.



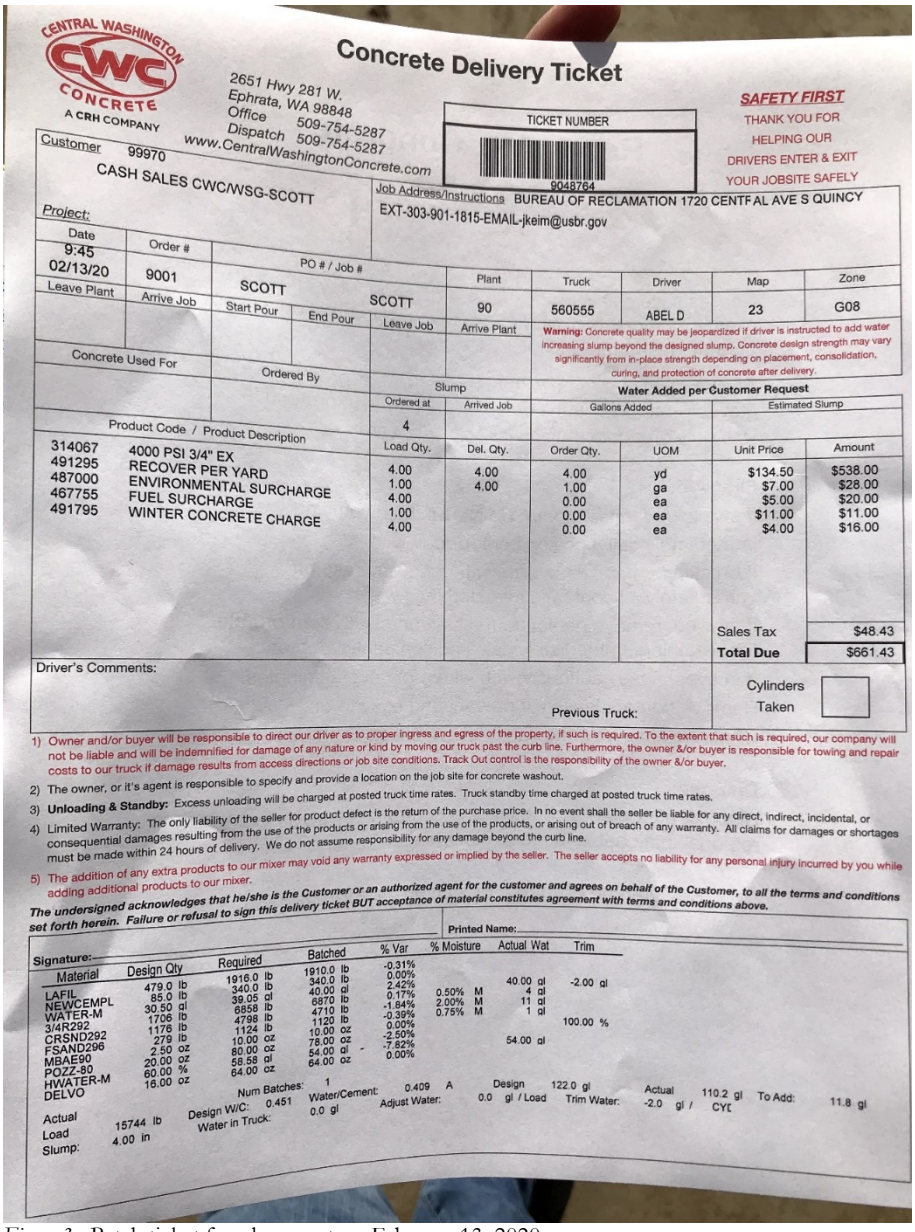
Notes:

- For Bolts: Use ½ inch cast-in Hex Head ASTM F1554 Gr 36 Bolt with 4 inch minimum embedment OR
- ½ inch diameter eyebolts with 4 inch minimum embedment

Figure 1- Sketch of panel form and welded-wire reinforcing

Figure 2 - Completed panel forms prior to concrete placement

The concrete mix used for the panels was supplied by a local ready-mix concrete supplier. CSL reviewed the mix design and concrete delivery was arranged by CSL prior to traveling to Quincy. The mix design used was a 4,000 psi, air entrained mix. See Figure 3 for the batch ticket.



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Customer 99970
CASH SALES CWC/WSG-SCOTT

Job Address/Instructions BUREAU OF RECLAMATION 1720 CENTF AL AVE S QUINCY
EXT-303-901-1815-EMAIL-jkeim@usbr.gov

Project:

Date	Order #	PO # / Job #		Plant	Truck	Driver	Map	Zone
9:45 02/13/20	9001	SCOTT	SCOTT	90	560555	ABEL D	23	G08

Leave Plant	Arrive Job	Start Pour	End Pour	Leave Job	Arrive Plant

Warning: Concrete quality may be jeopardized if driver is instructed to add water increasing slump beyond the designed slump. Concrete design strength may vary significantly from in-place strength depending on placement, consolidation, curing, and protection of concrete after delivery.

Concrete Used For | Ordered By

Slump: Ordered at 4 | Arrived Job

Water Added per Customer Request: Gallons Added | Estimated Slump

Product Code / Product Description	Load Qty.	Del. Qty.	Order Qty.	UOM	Unit Price	Amount
314067 4000 PSI 3/4" EX	4.00	4.00	4.00	yd	$134.50	$538.00
491295 RECOVER PER YARD	1.00	4.00	1.00	ga	$7.00	$28.00
487000 ENVIRONMENTAL SURCHARGE	4.00		0.00	ea	$5.00	$20.00
467755 FUEL SURCHARGE	1.00		0.00	ea	$11.00	$11.00
491795 WINTER CONCRETE CHARGE	4.00		0.00	ea	$4.00	$16.00
					Sales Tax	$48.43
					Total Due	$661.43

Driver's Comments:

Previous Truck:

Cylinders Taken

1) Owner and/or buyer will be responsible to direct our driver as to proper ingress and egress of the property, if such is required. To the extent that such is required, our company will not be liable and will be indemnified for damage of any nature or kind by moving our truck past the curb line. Furthermore, the owner &/or buyer is responsible for towing and repair costs to our truck if damage results from access directions or job site conditions. Track Out control is the responsibility of the owner &/or buyer.
2) The owner, or it's agent is responsible to specify and provide a location on the job site for concrete washout.
3) **Unloading & Standby:** Excess unloading will be charged at posted truck time rates. Truck standby time charged at posted truck time rates.
4) Limited Warranty: The only liability of the seller for product defect is the return of the purchase price. In no event shall the seller be liable for any direct, indirect, incidental, or consequential damages resulting from the use of the products or arising from the use of the products, or arising out of breach of any warranty. All claims for damages or shortages must be made within 24 hours of delivery. We do not assume responsibility for any damage beyond the curb line.
5) The addition of any extra products to our mixer may void any warranty expressed or implied by the seller. The seller accepts no liability for any personal injury incurred by you while adding additional products to our mixer.

The undersigned acknowledges that he/she is the Customer or an authorized agent for the customer and agrees on behalf of the Customer, to all the terms and conditions set forth herein. Failure or refusal to sign this delivery ticket BUT acceptance of material constitutes agreement with terms and conditions above.

Signature: Printed Name:

Material	Design Qty	Required	Batched	% Var	% Moisture	Actual Wat	Trim
LAFIL	479.0 lb	1916.0 lb	1910.0 lb	-0.31%			
NEWCEMPL	85.0 lb	340.0 lb	340.0 lb	0.00%			
WATER-M	30.50 gl	38.05 gl	40.00 gl	2.42%		40.00 gl	-2.00 gl
3/4R292	1706 lb	6858 lb	6870 lb	0.17%	0.50% M	4 gl	
CRSND292	1176 lb	4798 lb	4710 lb	-1.84%	2.00% M	11 gl	
FSAND296	279 lb	1124 lb	1120 lb	-0.39%	0.75% M	1 gl	
MBAE90	2.50 oz	10.00 oz	10.00 oz	0.00%			100.00 %
POZZ-80	20.00 oz	80.00 oz	78.00 oz	-2.50%			
HWATER-M	60.00 %	58.58 gl	54.00 gl	-7.82%		54.00 gl	
DELVO	18.00 oz	64.00 oz	64.00 oz	0.00%			

Num Batches: 1 | Design W/C: 0.451 | Water/Cement: 0.409 A | Design 122.0 gl | Actual 110.2 gl | To Add: 11.8 gl

Actual Load 15744 lb | Slump: 4.00 in | Water in Truck: 0.0 gl | Adjust Water: 0.0 gl / Load | Trim Water: -2.0 gl / CYE

Figure 3 - Batch ticket for placement on February 13, 2020

When the concrete arrived at the site, a sample was taken by Western Pacific Engineering and Survey, a local concrete materials testing laboratory, for fresh properties and compressive strength samples. A wheelbarrow was offloaded from the truck and a control panel was fabricated. A second wheelbarrow was offloaded and transferred into the mobile concrete mixer, Figure 4. CSL personnel introduced the various additives selected for this study into the small batch which was allowed to mix in the small mixer. After mixing, these smaller batches were offloaded into a wheelbarrow and moved into building to be placed into the corresponding panel forms. This process was repeated for each additive to be used in the test panels. Concrete properties testing was performed on each of these test batches. Fresh and hardened properties test results are presented in Appendix E.

Figure 4 - Mixer used to integrate admixtures

After the concrete was placed into the forms and finished, the panels were stored inside the shop building onsite at the QCBID maintenance yard for initial curing. See Figure 5.

The panels cast were:

Panel 1 – Control
Panel 2 – Copper Slag #40
Panel 3 – Copper Slag #60
Panel 4 – Copper Sulfate
Panel 5 – Darapel
Panel 6 – Smooth Finish
Panel 7 – Force 10,000 microsilica
Panel 8 – Sherwin Williams Loxon topical sealer

Figure 5 – Completed panels prior to curing, February 2020

The panels were placed into the canal on April 1, 2020, by QCBID staff as shown in Figure 6. Panels were photographed every month during the irrigation season and the photographs are presented in Appendix F. Algae grew on all panels and appeared to grow equally. At the end of the season, the panels were removed from the canal and photographed. Information on the observations over this time period are presented in the **Discussion** section of this report.

Figure 6 – Panels in canal April 1, 2020

2.4 2021 Study

Planning for the 2021 panel fabrication began in early 2021. Due to the COVID 19 pandemic, Reclamation staff could not travel to Quincy to assist in the fabrication of the panels. QCBID fabricated panels identical to the panels used in 2020. The same concrete supplier and mix design were used. All products trialed for mitigating algae growth in 2021 were topically applied materials. The selections are briefly discussed below, and their data sheets (if available) can be found in Appendix C.

1. Control
2. ConSeal ConBlock Topical
3. ConSeal ConBlock SH
4. Combination of ConSeal ConBlock Topical and SH
5. Combination of ConSeal ConBlock Topical and Sherwin Williams Loxon

Control

The control panel was made from a standard concrete typical in canal operations in the Quincy-Columbia area. The concrete was finished with a float finish which results in a somewhat roughened surface. This finish type is standard for canal concrete lining.

ConSeal ConBlock Topical

ConBlock Topical is a penetrating water repelling sealer that is applied to concrete surfaces to block the absorption of moisture. Additionally, ConBlock Topical contains ConBlock MIC, an EPA-registered antimicrobial, to protect the sealer from becoming compromised by mold, fungus, algae and some acid producing bacteria. ConBlock Topical was selected because it reduces the absorption of liquids on concrete keeping the concrete cleaner.

ConSeal ConBlock SH

ConBlock SH is a non-toxic, waterborne penetrating concrete sealer made from a proprietary blend of inorganic materials that reacts with Portland Cement Concrete to create crystalline formations within the concrete pore structure. ConBlock SH improves the durability, chemical resistance, and hardness, as well as reducing the porosity of concrete.

Combination of ConSeal ConBlock Topical and ConSeal SH

Per the recommendations of the ConSeal engineering manager, the two products were combined. This was based on success they had seen with reducing algae growth on concrete roofing tiles in Florida. The products were applied separately, the second after the first had dried.

Combination of ConSeal ConBlock Topical and Sherwin Williams Loxon

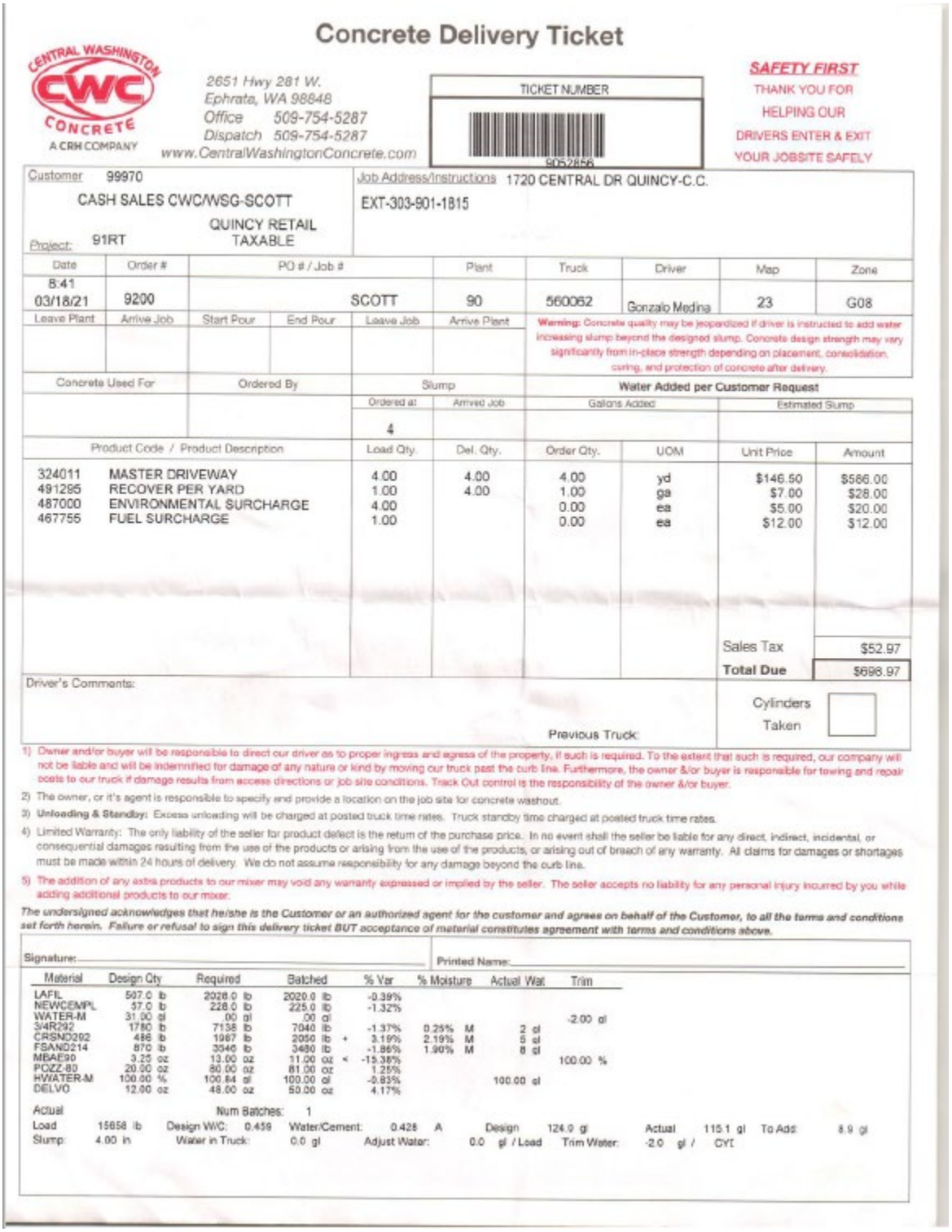
During panel fabrication, an extra panel form was made. QCBID staff decided to fill the form and finish it as the others had been. After curing, they decided to apply the three topical treatments to the panel. To see if it may be effective in reducing the growth of algae.

The manufacturers of Microban antimicrobial cleaner also manufacturer a concrete admixture called Excalibur. Excalibur claims to be an antimicrobrial which is effective in reducing the growth of microorganisms and provides increased hydrophobicity in concrete. When contacted about their product, Microban International stated that they were in a sold-out position for their product at that time and were only interested in brand licensing the product. For these reasons, their product was not trialed.
Although there are many non-fouling coating products for marine environments these were not generally considered for this study due to their high cost per square foot price. Application to concrete typically requires multiple coats (primer, tie coat and final coat).

QCBID staff fabricated the panels on March 18, 2021. One control panel and four panels with topically applied products listed above were fabricated as described in section 2.1 except the moving of small loads into a mixer to add integral products was not necessary in 2021. After a concrete curing period, the products listed above were applied to the surface of the panels per the manufacturer's instructions and allowed to dry. Figure 7 shows the panels after fabrication with the

surface treatments applied. A slightly different concrete mix was utilized for this placement. The batch ticket is presented in Figure 8. The concrete for the panels was again tested and the fresh and hardened properties test results are presented in Appendix E.

Figure 7 – 2021 panels with topically applied products



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QUINCY RETAIL TAXABLE
Project: 91RT

Job Address/Instructions 1720 CENTRAL DR QUINCY-C.C.
EXT-303-901-1815

Date	Order #	PO # / Job #	Plant	Truck	Driver	Map	Zone
8:41 03/18/21	9200	SCOTT	90	560062	Gonzalo Medina	23	G08

Leave Plant	Arrive Job	Start Pour	End Pour	Leave Job	Arrive Plant

Warning: Concrete quality may be jeopardized if driver is instructed to add water increasing slump beyond the designed slump. Concrete design strength may vary significantly from in-place strength depending on placement, consolidation, curing, and protection of concrete after delivery.

Concrete Used For	Ordered By	Slump Ordered at	Slump Arrived Job	Water Added per Customer Request: Gallons Added	Estimated Slump
		4			

Product Code / Product Description	Load Qty.	Del. Qty.	Order Qty.	UOM	Unit Price	Amount
324011 MASTER DRIVEWAY	4.00	4.00	4.00	yd	$146.50	$586.00
491295 RECOVER PER YARD	1.00	4.00	1.00	ea	$7.00	$28.00
487000 ENVIRONMENTAL SURCHARGE	4.00		0.00	ea	$5.00	$20.00
467755 FUEL SURCHARGE	1.00		0.00	ea	$12.00	$12.00
					Sales Tax	$52.97
					Total Due	$698.97

Driver's Comments:

Previous Truck:

Cylinders Taken

1) Owner and/or buyer will be responsible to direct our driver as to proper ingress and egress of the property, if such is required. To the extent that such is required, our company will not be liable and will be indemnified for damage of any nature or kind by moving our truck past the curb line. Furthermore, the owner &/or buyer is responsible for towing and repair costs to our truck if damage results from access directions or job site conditions. Track Out control is the responsibility of the owner &/or buyer.
2) The owner, or it's agent is responsible to specify and provide a location on the job site for concrete washout.
3) **Unloading & Standby:** Excess unloading will be charged at posted truck time rates. Truck standby time charged at posted truck time rates.
4) Limited Warranty: The only liability of the seller for product defect is the return of the purchase price. In no event shall the seller be liable for any direct, indirect, incidental, or consequential damages resulting from the use of the products or arising from the use of the products, or arising out of breach of any warranty. All claims for damages or shortages must be made within 24 hours of delivery. We do not assume responsibility for any damage beyond the curb line.
5) The addition of any extra products to our mixer may void any warranty expressed or implied by the seller. The seller accepts no liability for any personal injury incurred by you while adding additional products to our mixer.

The undersigned acknowledges that he/she is the Customer or an authorized agent for the customer and agrees on behalf of the Customer, to all the terms and conditions set forth herein. Failure or refusal to sign this delivery ticket BUT acceptance of material constitutes agreement with terms and conditions above.

Signature: Printed Name:

Material	Design Qty	Required	Batched	% Var	% Moisture	Actual Wat	Trim
LAFIL	507.0 lb	2026.0 lb	2020.0 lb	-0.39%			
NEWCEMPL	57.0 lb	228.0 lb	225.0 lb	-1.32%			
WATER-M	31.00 gl	.00 gl	.00 gl				-2.00 gl
3/4R292	1780 lb	7138 lb	7040 lb	-1.37%	0.25% M	2 gl	
CRSND202	486 lb	1987 lb	2050 lb +	3.19%	2.19% M	5 gl	
FSAND214	870 lb	3546 lb	3480 lb	-1.86%	1.90% M	8 gl	
MBAE90	3.25 oz	13.00 oz	11.00 oz <	-15.38%			100.00 %
POZZ-60	20.00 oz	80.00 oz	81.00 oz	1.25%			
HWATER-M	100.00 %	100.84 gl	100.00 gl	-0.83%		100.00 gl	
DELVO	12.00 oz	48.00 oz	50.00 oz	4.17%			

Actual Num Batches: 1

Load 15858 lb Design W/C: 0.459 Water/Cement: 0.428 A Design 124.0 gl Actual 115.1 gl To Add: 8.9 gl

Slump: 4.00 in Water in Truck: 0.0 gl Adjust Water: 0.0 gl / Load Trim Water: -2.0 gl / CYI

Figure 8 – Batch ticket for placement on March 18, 2021

Panels were placed into the canal on April 21, 2021, as shown in Figures 9-13. One notable difference was that the wooden forms were not removed from the panels prior to putting them in the canal as they were in the 2020 study. The panels were removed from the canal monthly and photographed. The photographs for the 2021 irrigation season are presented in Appendix G. Water temperature recording for 2021 are shown in Figure 14.

Figure 9 - Panels delivered to canal, April 2021

Figure 10 – Panels being lifted into the canal, April 2021

Figure 11 – Panel being set into canal, April 2021

Figure 12 – Panels lined up in canal, April 2021

Figure 13 – Panels in canal at beginning of irrigation season, April 2021

Table 1 – 2021 canal water temperature recordings

Date	Temperature
	° F
5/21/2021	60
6/21/2021	68
7/16/2021	71
8/17/2021	70
9/3/2021	71
9/21/2021	68
10/8/2021	55
10/22/2021	50

3. Discussion

Panels from each year were removed from the canal at the end of the irrigation season. The panels cast in 2020 were removed from the canal on October 14, 2020. Photographs from the entire irrigation season as well as a composite summary for the panels are presented in Appendix C. All the panels had algae growth, which became noticeable in August 2020. The panel which had the Sherwin William Loxon Self-Cleaning coating applied had slightly less algae growth in August 2020, but the coating did not mitigate the growth of the algae and the panels had equal growth when removed from the canal. The concrete panel (#6) with a smoother finish also did not appear to have any significant change in the algae condition.

The panels cast in 2021 were removed from the canal on October 22, 2021. Photographs from the entire irrigation season as well as a composite summary for the panels are presented in Appendix D. The water temperatures were recorded on the compilation of pictures. Staff from QCBID stated that the panels showed lichen (possibly Trapeliaceae) growth with light algae growth along the sides of the panels. Insect casings were also observed on the panels by QCBID staff. Since the wooden formwork was not removed prior to placement in the canal, it is unclear what affect that may have had on algae growth. The panels did not show algae growth until August 2021, but the panels had less algae growth than the panels cast in 2020. Unfortunately, it is hard to decern if this was a general effectiveness of any of the topical treatments or just an anomaly due to seasonal variations. QCBID staff stated that 2021 was an unusual irrigation season and that the main canal had some algae growth on the canal lining but not as much as in a typical season. It was also stated that there had been more pondweed in the canals in 2021 than in typical years. It isn't clear if this was a result of less algae growth or from some other environmental variable that may have arisen in 2021.

3.1 Recommendations

Given the 2021 observations, it would seem that the topically applied products tested on the panels should be trialed further as there was clearly a difference from the 2020 study. Future proposals should reference a Technology Readiness Level TRL 6, *engineering-scale models or protypes tested in a relevant environment.* A field trail could be accomplished on in-service full concrete canal panels that can be monitored and tested over time. The panels should be cleaned prior to coating application and the coatings applied prior to the canal being watered up for the season. If panel replacements take place, those panels can be treated with the topical sealers and observed as well. The panels should be observed over multiple irrigation seasons. These panels should be in an area where copper sulfate or other treatments are not used. Water temperatures should be monitored and recorded monthly, and photographs taken to determine if algae growth on the treated panels is less than algae growth on nearby uncoated panels.

Although the 2020 study did not show favorable results with integral additives, the concept of should not be fully disregarded. Additional physical characteristics of concrete may still be able ot be obtained with admixture or additives of a different nature. It does appear that the concrete surfaces did not have a significant impact or inhibit algae growth.

Admixture and sealer manufacturers should be further engaged so they are aware of the issue and may begin some research work on finding a product that can mitigate the development of algae blooms in canals. This concept should also be evaluated to determine if it would be a good fit for a Reclamation Research and Development Prize Competition.

Reclamation had discussed the algae growth issue with one admixture manufacturer that expressed an interest in trying to develop a product that may help mitigate algae development on concrete lined canals. Other manufactures may also be interested. Given that there are now some observational results, reengaging with an admixture or sealant manufacturer may be advantageous in that they may be willing to begin development of a product specifically for mitigating algae growth.

Appendix A

Literature Search References

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Appendix B

Water Sample Test Results

Phytoplankton Sample Analysis

Sample: 5th Sec @ 262
Sample Site: 5th Sec @ 262
Sample Depth: 1420
Sample Date: 3-Jun-19

Total Density (#/mL): 2,699
Total Biovolume (um^3/mL): 4,348,904
Trophic State Index: 60.4

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent	Group
1	Achnanthes minutissima	444	16.5	22,208	0.5	diatom
2	Tabellaria fenestrata	308	11.4	2,361,600	54.3	diatom
3	Nitzschia frustulum	239	8.9	28,700	0.7	diatom
4	Navicula cryptocephala	239	8.9	44,246	1.0	diatom
5	Cymbella minuta	171	6.3	63,208	1.5	diatom
6	Cyclotella ocellata	171	6.3	25,625	0.6	diatom
7	Synedra rumpens	137	5.1	19,133	0.4	diatom
8	Fragilaria construens	103	3.8	45,920	1.1	diatom
9	Cymbella affinis	103	3.8	184,500	4.2	diatom
10	Cymbella cymbiformes	103	3.8	986,255	22.7	diatom
11	Fragilaria pinnata	68	2.5	4,100	0.1	diatom
12	Cyclotella comta	68	2.5	155,117	3.6	diatom
13	Synedra ulna	68	2.5	203,975	4.7	diatom
14	Asterionella formosa	68	2.5	67,650	1.6	diatom
15	Nitzschia palea	34	1.3	6,150	0.1	diatom
16	Rhodomonas minuta	34	1.3	683	0.0	cryptophyte
17	Cocconeis placentula	34	1.3	15,717	0.4	diatom
18	Amphora coffeiformes	34	1.3	3,246	0.1	diatom
19	Cymbella microcephala	34	1.3	1,811	0.0	diatom
20	Amphora perpusilla	34	1.3	5,672	0.1	diatom
21	Fragilaria crotonensis	34	1.3	57,400	1.3	diatom
22	Diatoma tenue elongatum	34	1.3	24,600	0.6	diatom
23	Navicula cryptocephala veneta	34	1.3	3,246	0.1	diatom
24	Gomphonema angustatum	34	1.3	6,150	0.1	diatom
25	Fragilaria capucina mesolepta	34	1.3	8,713	0.2	diatom
26	Fragilaria construens venter	34	1.3	3,280	0.1	diatom

Phytoplankton Sample Analysis

Sample: Adco
Sample Site: M16.9
Sample Depth:
Sample Date: 3-Jun-19 1030

Total Density (#/mL): 766
Total Biovolume (um^3/mL): 1,749,854
Trophic State Index: 53.9

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent	Group
1	Cyclotella ocellata	238	31.0	29,729	1.7	diatom
2	Tabellaria fenestrata	229	29.9	1,539,038	88.0	diatom
3	Rhodomonas minuta	150	19.5	2,995	0.2	cryptophyte
4	Cryptomonas erosa	35	4.6	18,322	1.0	cryptophyte
5	Asterionella formosa	26	3.4	13,371	0.8	diatom
6	Dinobryon sertularia	18	2.3	2,114	0.1	chrysophyte
7	Chlamydomonas sp.	9	1.1	2,863	0.2	green
8	Synedra radians	9	1.1	3,171	0.2	diatom
9	Sphaerocystis schroeteri	9	1.1	4,933	0.3	green
10	Diatoma tenue elongatum	9	1.1	38,053	2.2	diatom
11	Kephyrion littorale	9	1.1	837	0.0	chrysophyte
12	Fragilaria crotonensis	9	1.1	73,992	4.2	diatom
13	Achnanthes minutissima	9	1.1	440	0.0	diatom
14	Cyclotella comta	9	1.1	19,996	1.1	diatom

Phytoplankton Sample Analysis

Sample: Quincy
Sample Site: W36 check
Sample Depth:
Sample Date: 3-Jun-19 1320

Total Density (#/mL): 1,091
Total Biovolume (um^3/mL): 1,917,440
Trophic State Index: 54.5

	Species	Density #/mL	Density Percent	Biovolume um^3/mL	Biovolume Percent	Group
1	Tabellaria fenestrata	290	26.5	1,667,698	87.0	diatom
2	Cyclotella ocellata	200	18.4	25,056	1.3	diatom
3	Rhodomonas minuta	134	12.2	2,673	0.1	cryptophyte
4	Nitzschia frustulum	78	7.1	9,354	0.5	diatom
5	Achnanthes minutissima	67	6.1	3,341	0.2	diatom
6	Synedra radians	56	5.1	20,044	1.0	diatom
7	Diatoma tenue elongatum	22	2.0	16,036	0.8	diatom
8	Kephyrion littorale	22	2.0	2,116	0.1	chrysophyte
9	Cyclotella comta	22	2.0	50,557	2.6	diatom
10	Gomphonema angustatum	22	2.0	4,009	0.2	diatom
11	Cryptomonas erosa	22	2.0	11,581	0.6	cryptophyte
12	Dinobryon sertularia	22	2.0	6,681	0.3	chrysophyte
13	Fragilaria construens venter	11	1.0	535	0.0	diatom
14	Cymbella minuta	11	1.0	4,120	0.2	diatom
15	Asterionella formosa	11	1.0	19,599	1.0	diatom
16	Achnanthes linearis	11	1.0	1,470	0.1	diatom
17	Navicula minuscula	11	1.0	501	0.0	diatom
18	Nitzschia dissipata	11	1.0	2,996	0.2	diatom
19	Fragilaria crotonensis	11	1.0	56,124	2.9	diatom
20	Navicula cryptocephala veneta	11	1.0	1,058	0.1	diatom
21	Synedra rumpens	11	1.0	3,118	0.2	diatom
22	Nitzschia paleacea	11	1.0	1,091	0.1	diatom
23	Nitzschia palea	11	1.0	2,004	0.1	diatom
24	Fragilaria capucina mesolepta	11	1.0	5,679	0.3	diatom

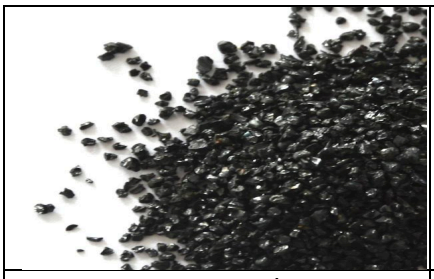
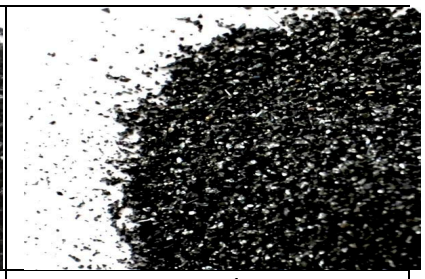
Appendix C

Admixture and Sealant Product Data Sheets

Universal Minerals Kentucky, Inc. (UMKI)
8250 Port Road, Louisville, KY 40258
www.um-ky.com
SALES MANAGER: pat.conry@um-ky.com
CUSTOMER SERVICE: 502-933-1932

SHARPSHOT®*XL* TECHNICAL DATA SHEET

(Premium Iron Silicate Abrasives)

		
COARSE 12/30	MEDIUM 20/50	FINE 40/100
The Sharpshot® XL Coarse is a heavy duty size for the removal of layers of old paint and rust from ships, bridges, tanks, etc. This coarse sizing typically - with properly working equipment - produces a 4.5-5.5 mil profile	The Sharpshot® XL medium size is for general purpose blasting jobs. This medium sizing typically - with properly working equipment - produces a 3.5-4.0 mil profile. This is also the preferred size for underwater water jet cutting applications.	The Sharpshot® XL fine grade abrasive is for use on carpet, plastic and wood. Also often used for antique restoration for automobile surface preparation, this fine sizing, typically - with properly working equipment - produces a profile of less than 1.5 mils.

TYPICAL SIZING

US Std. Sieve #	% Retained		
	COARSE (12x30)	MEDIUM (20x50)	FINE (40x100)
8	0-1	0	
12	0-15		
16	25-45		
20	25-45	5-25	0
30	10-30	35-65	
-30	0-10		
40		10-30	0-15
50		5-20	10-35
60		0-15	15-40
70		0-10	5-25
-70		0-5	
80			5-20
100			5-25
120			0-15
-120			0-10

ADVANTAGE: SHARPSHOT®*XL*

- Use on new and coated steel
- Environmentally friendly
- Recyclable
- Low free silica (<0.1%)
- Extremely low dusting
- Faster surface blasting
- Low material consumption rate
- Low cost per sq. ft.
- Sharpshot XL qualifies as a Type II, Class A abrasive when tested in accordance with section 4.1 of SSPC Abrasive Standard No. 1 (SSPC-AB-1)

PHYSICAL PROPERTIES			COMPONENTS	% Weight	
Hardness	>6		Iron Oxide	50-60	
Specific Gravity	3.4-3.6		Amorphous Silica (silicates)	30-35	
Color	Shiny Black		Free Silica (crystalline)	<0.1	
Shape	Granular		Calcium oxide	1-3	
Bulk Density	120-130lbs / ft^3		Magnesium oxide	1-2	
			Potassium Oxide	1-2	
			Alpha-Alumina	3-5	

DARAPEL®

Integral water repellent admixture

Product Description

DARAPEL® admixture is a stable dispersion of stearate and other water repellent compounds that is added into ready mixed concrete during mixing. DARAPEL® is a ready-to-use, factory prepared liquid that will simplify handling and eliminate guesswork.

Uses

Architects, engineers, contractors and other authorities agree that even good quality concretes, mortars, etc. that are properly placed, set or applied then cured, are inherently porous or permeable to water. The free passage of moisture occurs in pores formed during and after placing. DARAPEL® forms an internal barrier against water transmission in mixes used for ready mixed or precast concrete.

Performance

The addition of DARAPEL® to the mix will provide hydrophobic (water-repelling) properties. The water insoluble stearate acts as a non-wettable lining on the walls of all pores and voids in the mix, making them water repellent. The DARAPEL® "built-in" water barriers guard against damage caused by water infiltration.

Improved Product Quality

Higher quality concrete will result from the use of DARAPEL® The workability of mixes will be improved especially in low cement content concrete mixes. The protection of embedded steel and resistance to bacteria or fungus growth may also be increased by keeping the concrete drier.

Product Advantages

The addition of DARAPEL® will reduce the amount of water that permeates through the concrete. Reducing the passage of water will provide beneficial advantages by:

- Increasing resistance to weathering
  - wetting and drying
  - freezing and thawing
- Increase resistance to chemical attack
- Reduce the potential for efflorescence
- Reduce the probability of corrosion of embedded meta

Air Content

Added by itself, DARAPEL® may have a slight effect on the entrained air volume. Trial mixes or field tests are recommended to evaluate its effect with your material at your plant. Over-dosing can cause variations in air content.

Curing

Proper curing of the in-place mix is vital. Allowing the mix to prematurely dry out should be prevented because re-wetting (and continued hydration) may not be effective.

Dispensing Equipment

It is recommended that DARAPEL® be dispensed into the concrete and thoroughly mixed to provide complete dispersion. DARAPEL® can be added at any point during the charging of the mixer.

A complete line of automated, high precision dispensing equipment is available for plant installation through your GCP admixtures representative.

Packaging and Handling

DARAPEL® is available in totes, drums and pails.

DARAPEL® will freeze at approximately 32°F (0°C) and cannot be remixed after freezing.

Flammability

None.

Addition Rates

The amount of DARAPEL® necessary for a specific mix depends upon the degree of water repellency desired. Suggested addition rates for DARAPEL® in ready mixed or precast concrete are 3.0 to 6.0 fl oz/100 lb (190 to 390 mL/100 kg) of cement.

Compatibility with Other Admixtures and Batch Sequencing

DARAPEL® can be added to mixes containing other admixtures. Testing with actual materials should be done to determine performance. Each admixture must be added separately to the mix. Do not allow any of the admixtures to contact each other before they enter the mix.

The GCP Advantage in Admixtures

DARAPEL® was developed by GCP Applied Technologies - recognized world-wide as a leader in concrete admixture technology. Pioneers in this specialized field for over 50 years, we operate one of the largest privately owned cement and concrete research laboratories.

Our admixtures are manufactured in modern U.S. and Canadian plants, under strict quality controls which assure their quality, uniformity and performance. Highly trained GCP admixture specialists are ready to assist you in their use.

Today, when so much depends on every element of a construction project, you can rely on the special combination of experience, product quality and technical support which are the “GCP Advantage” in admixtures.

GCP Applied Technologies Inc., 62 Whittemore Avenue, Cambridge, MA 02140 USA.

In Canada, 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

FORCE 10,000® D

High performance concrete admixture dry densified powder

Product Description

FORCE 10,000®D is a dry densified microsilica (silica fume) powder designed to increase concrete compressive and flexural strengths, increase durability, reduce permeability and improve hydraulic abrasion-erosion resistance. The specific gravity of FORCE 10,000®D is 2.20.

Uses

FORCE 10,000®D can be used to consistently produce concrete with strengths of 6,000 psi (42 MPa) and higher in most instances with locally available materials and existing methods. It may also be used in precast and prestress applications where high early strengths are required.

The addition of FORCE 10,000®D also produces concrete with increased watertightness and dramatically reduced permeability compared to conventional mixes. Reduced permeability is an important advantage in slowing the intrusion of chloride where corrosion of reinforcing steel is a potential problem. Examples are parking garages, bridge decks and concrete in a marine environment. FORCE 10,000®D also enhances the durability of concrete against aggressive chemical attack and in hydraulic abrasion-erosion applications.

Preconstruction Trial Mix

It is strongly recommended that trial mixes be made several weeks before construction start up. This will allow the concrete producer an opportunity to determine the proper batching sequence and amounts of other admixtures needed in order to deliver the required concrete mix to the job site. A trial mix will also help determine whether the combination of concrete materials and construction practices will allow the concrete to meet a specified performance. GCP's broad experience with this product can help the concrete producer deliver a satisfactory product regardless of the mixture proportions. Contact your GCP Applied Technologies sales representative for help with trial mixes.

Finishing & Curing

FORCE 10,000®D concrete can be used in flatwork with little or no modification to the recommended practices outlined in ACI 302, *Guide for Concrete Floor and Slab Construction*.

FORCE 10,000®D will reduce the surface bleed water of concrete in large applications. ACI 308, *Standard Practice for Curing Concrete*, must be followed to ensure that any problems that can occur due to decreased bleeding are minimized. Your GCP Applied Technologies representative is available to review your particular job needs.

Performance

FORCE 10,000®D improves concrete through two mechanisms. The extremely fine microsilica particles are able to fill the microscopic voids between the cement particles, creating a less permeable structure. In addition, the microsilica reacts with the free calcium hydroxide within the concrete to form additional calcium silicate hydrate (glue), producing a tighter paste-to-aggregate bond. FORCE 10,000®D does not affect concrete set times.

FORCE 10,000®D will improve the mechanical properties of concrete. In order to meet specified concrete performance levels, however, many variables are involved. These include, but are not limited to; concrete materials, weather conditions, testing techniques and mixing, transporting, placing and finishing practices. ACI and ASTM guidelines must be strictly adhered to.

Addition Rates

FORCE 10,000®D dosage rates will vary based on the requirements of the application. Dosage rates should be calculated on percent microsilica by weight of cement, or on lb/yd^3 (kg/m^3) of concrete, as appropriate. Dosage rates will be as specified. If not specified, consult your GCP Applied Technologies representative for your particular job needs.

Compatibility with Other Admixtures and Batch Sequencing

FORCE 10,000®D is compatible with all conventional water reducers, superplasticizers, set retarders and DCI® corrosion inhibitor. Any air-entraining agent which works effectively with superplasticizers and microsilica, particularly vinsol resins such as DARAVAIR®by GCP Applied Technologies, are recommended. Only non-chloride set accelerators, such as POLARSET®, may be used with FORCE 10,000®D concrete. All admixtures must be added separately to assure their prescribed performance. Trial mixes and pretesting of concrete are recommended to optimize dosage rates, and ensure ultimate performance.

FORCE 10,000®10,000 D can be used in either central or transit mix concrete production. FORCE 10,000®D may be used in conjunction with waterreducing admixtures (both normal and high-range as approved by ASTM) to assure workability of the mix.

Packaging, Handling and Storage

FORCE 10,000®D is available in bulk, and 25 lbs (11.4 kg) Concrete Ready Bags™.

Bagged FORCE 10,000®D should be stored in a dry, protected area. Manual dispensing by tearing the bags is the normal method. A dust mask should be used when dispensing the bagged product, consult the product MSDS for more complete instructions.

Dispensing Equipment

Bulk FORCE 10,000®D may be stored in already existing cement silos. The silos must be completely clean with no foreign residue remaining which may cause contamination. Up-pipes to the silo for unloading bulk tankers should also be clean and clear of obstructions. Small diameter 4 in. (100 mm) rigid metal pipes with several angles (especially right angles) will cause longer unloading times. Large diameter 6 in. (150 mm) flat lined, flexible rubber pipes will allow for the least unloading time. Dispensing bulk FORCE 10,000®D will take place in the same manner as that used for cement. Augering or dropping from the silo to the weigh hopper is the usual practice.

Loxon®

Self-Cleaning Acrylic Coating-Flat

LX13-50 Series

CHARACTERISTICS

Loxon Self-Cleaning Acrylic Coating is specifically engineered for exterior, above-grade, masonry surfaces requiring a clean and attractive look while providing high performance protection with enhanced water shedding and dirt pick-up resistant properties. This may be applied to a surface with a pH of6 to 13.

Loxon Self-Cleaning Acrylic Coating is formulated to be self-cleaning by shedding dirt upon rain or water contact.

Key Attributes and Benefits:

Excellent dirt pick up resistance

Excellent water shedding

Resistant to wind driven rain

Hydrophobic characteristics

Adhesion to many concrete surfaces, wood and EIFS

Highly alkali and efflorescence resistant

Apply directly to fresh concrete (at least 7 days old)

Can be applied down to 35°F

Color:	Many Colors
Coverage:	
Wet mils:	5-7
Dry mils:	2.0-2.8
Coverage sq.ft. per gallon	225-325

Coverage on porous & rough stucco 125 square feet per gallon

Drying Schedule @ 50% RH: temperature and humidity dependent

	@ 77°F
Touch:	4 hours
Recoat:	24 hours

No maximum recoat time. Drying and recoat times are temperature, humidity, and film thickness dependent.

Finish: 0-10 units @ 60°

Tinting with CCE only:

Base	oz. per gallon	Strength
Extra White	0-7	SherColor
Deep Base	4-12	SherColor
Ultradeep	10-12	SherColor
Light Yellow	0-12	SherColor

Extra White LX13W0051
(may vary by color)

V.O.C. (less exempt solvents):

less than 50 grams per litre; 0.42 lbs. per gallon
As per 40 CFR 59.406

Volume Solids:	41 ± 2%
Weight Solids:	57 ± 2%
Weight per Gallon:	10.27 lb
Flash Point:	NA
Vehicle Type:	100% Acrylic
Shelf Life:	36 months,unopened

Mildew Resistant:
This coating contains agents which inhibit the growth of mildew on the surface of this coating film. Passes ASTM D3273/D3274

COMPLIANCE

As of 02/25/2022, Complies with:

OTC	Yes
OTC Phase II	Yes
S.C.A.Q.M.D.	Yes
CARB	Yes
CARB SCM 2007	Yes
CARB SCM 2020	Yes
Canada	Yes
LEED® v4 & v4.1 Emissions	N/A
LEED® v4 & v4.1 V.O.C.	Yes
EPD-NSF® Certified	N/A
MIR-Product Lens Certified	N/A
MPI®	Yes

APPLICATION

Temperature:

minimum 35°F

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

Reducer:	No reduction necessary
Airless Spray:	
Pressure	2000 p.s.i.
Tip	.017-.021 inch
Brush	Use a nylon-polyester brush. Purdy Pro-Extra
Roller Cover	Use a 1/2 to 3/4 inch nap synthetic cover. Purdy Marathon

Spray and backroll on porous & rough stucco to achieve required film build and a pin-hole free surface.

For porous block a coat of Loxon Acrylic Block Surfacer is required to achieve a pinhole free surface.

Apply at temperatures above 35°F. When the air temperature is at 35°F, substrates may be colder; prior to painting, check to be sure the air, surface, and material temperature are above 35°F and at least 5°F above the dew point. Avoid using if rain or snow is expected within 2-3 hours.

Do not apply at air or surface temperatures below 35°F or when air or surface temperatures may drop below 35°F within 48 hours.

For best performance results, avoid painting in direct sun or painting substrates with elevated surface temperatures.

Use high bond exterior painter's tape such as ShurTape FROGTAPE® High Bond Exterior Painter's Tape™ (SMIS651259798) when coated surface requires masking. Allow coating to dry 24 hours prior to applying to surface.

Do not reduce.

APPLICATION TIPS

Sealing and Patching-After cleaning the surface thoroughly, prime the concrete surface with Loxon Self-Cleaning Acrylic Coating, apply an elastomeric patch or sealant if needed, allow to dry, then topcoat.

To improve the performance consider:

Use caution when preparing the substrate to create a uniform surface.

Cracks, crevices, and through-wall openings must be patched with an elastomeric patch or sealant.

Fill voids and openings around window and doors with an elastomeric patch or sealant.

Stripe coat all inside and outside corners and edges with 1 coat of Loxon Self-Cleaning coating.

Caulking:

Gaps between windows, doors, trim, and other through-wall openings can be filled with the appropriate caulk after priming the surface.

RECOMMENDED SYSTEMS

Concrete, Masonry, Stucco, EIFS

Self-Prime using 2 coats of Loxon Self-Cleaning

Or

1 coat Loxon Concrete and Masonry Primer (if needed) or

Loxon Conditioner (if needed)

2 coats Loxon Self-Cleaning

CMU, Block, Split-face Block:

1 coat Loxon Acrylic Block Surfacer

Or

Pro Industrial Heavy Duty Block Filler

2 coats Loxon Self-Cleaning

Wood:

1 coat Exterior Latex Primer

2 coats Loxon Self-Cleaning

Previously Coated in good condition:

After power washing, apply 1-2 coats of Loxon Self-Cleaning over the surface.

continued on back

Loxon®
Self-Cleaning Acrylic Coating-Satin

SURFACE PREPARATION

WARNING! Removal of old paint by sanding, scraping or other means may generate dust or fumes that contain lead. Exposure to lead dust or fumes may cause brain damage or other adverse health effects, especially in children or pregnant women. Controlling exposure to lead or other hazardous substances requires the use of proper protective equipment, such as a properly fitted respirator (**NIOSH** approved) and proper containment and cleanup. For more information, call the National Lead Information Center at **1-800-424-LEAD** (in US) or contact your local health authority.

Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Scrape and sand peeled or checked paint to a sound surface. Sand glossy surfaces dull. Seal stains from water, smoke, ink, pencil, grease, etc. with the appropriate primer-sealer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

Masonry, Concrete, CMU:

Remove all dirt, dust, mildew, loose particles, laitance, foreign material, peeling and defective coatings, chalk, form release agents, moisture curing membranes, etc.

On tilt-up and poured-in-place concrete, commercial detergents and sandblasting may be necessary to remove sealers, release compounds, and to provide an anchor pattern.

Allow the surface to dry thoroughly.

Concrete and mortar must be cured at least 7 days at 75°F to apply this product directly. Fill bugholes, air pockets, cracks, and other voids with an elastomeric patch or sealant. Rough and porous block can be filled using Loxon Acrylic Block Surfacer to provide a smooth surface.

Cement Composition Siding/Panels:

Remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. Concrete and masonry must be cured at least 7 days at 75°F. Fill bugholes, air pockets, cracks, and other voids with an elastomeric patch or sealant. Rough surfaces can be filled to provide a smooth surface.

Incidental Metal:

Wash to remove any oil, grease, or other surface contamination. All corrosion must be removed with sandpaper, wire brush, or other abrading method. Primer required.

Wood:

Sand any exposed wood to a fresh surface. Patch all holes and imperfections with a wood filler or putty and sand smooth. All patched areas must be primed. Primer required.

SURFACE PREPARATION

Mildew:

Prior to attempting to remove mildew, it is always recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions may be advised.

Mildew may be removed before painting by washing with a solution of 1 part liquid bleach and 3 parts water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with water and allow the surface to dry before painting. Wear protective eyewear, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach-water solution.

PHYSICAL PROPERTIES

Do not paint on wet surfaces.

LX13W0051

Wind-Driven Rain Test :	Pass
Method:	ASTM D6904-03
2 coats	Loxon Self-Cleaning @ 4.2 mils d.f.t
Water Vapor Permeance :	
	ASTM D1653 26.1 perms
	ASTM E96 23.4 perms
Method:	ASTM D1653 & E96 14 day cure @ 77°F & 50% RH
1 coat	Loxon Self-Cleaning @ 4.3 mils d.f.t.
Elongation :	159%
Method:	ASTM D2370, 14 day cure @ 77°F & 50% RH
1 coat	Loxon Self-Cleaning @ 4.8 mils dft
Tensile Strength :	224 p.s.i.
Method:	ASTM D2370, 14 day cure @ 77°F & 50% RH
1 coat	Loxon Self-Cleaning @ 4.8 mils dft
Flexibility:	
Method:	ASTM D522, method B, 180° bend, 1/8 inch mandrel
Result:	Pass
Alkali Resistance:	
Method:	ASTM D1308
Result:	Pass
Mildew Resistance:	
Method:	ASTM D3273/D3274
Result:	Pass
Efflorescence:	
Method:	ASTM D7072-04
Result:	None

CAUTIONS

For exterior use only.

Protect from freezing.

Non-photochemically reactive.

Not for use on horizontal surfaces (floors, roofs, decks, etc.) where water will collect.

Not for use below grade. Will not withstand hydrostatic pressure.

Before using, carefully read **CAUTIONS** on label.

ZINC. Use only with adequate ventilation. To avoid overexposure, open windows and doors or use other means to ensure fresh air entry during application and drying. If you experience eye watering, headaches, or dizziness, increase fresh air, or wear respiratory protection (**NIOSH** approved) or leave the area. Avoid contact with eyes and skin. Wash hands after using. Keep container closed when not in use. Do not transfer contents to other containers for storage. **FIRST AID:** In case of eye contact, flush thoroughly with large amounts of water. Get medical attention if irritation persists. If swallowed, call Poison Control Center, hospital emergency room, or physician immediately. **WARNING:** This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. **DO NOT TAKE INTERNALLY. KEEP OUT OF THE REACH OF CHILDREN.**

HOTW 02/25/2022 LX13W0051 08 42 FRC, SP

CLEANUP INFORMATION

Clean spills, spatters, hands and tools immediately after use with soap and warm water. After cleaning, flush spray equipment with a compliant cleanup solvent to prevent rusting of the equipment. Follow manufacturer's safety recommendations when using solvents.

SEAL OF SECURITY
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CONCRETE SEALANTS INC.
Don't Just Seal It, ConSeal It!

ConBlock™ SH

Sodium-based Surface Hardener

Waterborne Penetrating, Reactive Concrete Sealer, Hardener, and Dust-proofer

Product Description

ConBlock SH is a non-toxic, waterborne penetrating concrete sealer made from a proprietary blend of inorganic materials that reacts with Portland Cement Concrete to create crystalline formations within the concrete pore structure. Applying ConBlock SH improves the durability, chemical resistance, and hardness, as well as reducing the porosity of concrete.

Additionally, ConBlock SH reduces "dusting" on concrete surfaces which is beneficial in preparing the surface for the application of coatings and adhesives. ConBlock SH will not change the color of your concrete and can be polished after treatment to create a glossy sheen. Since ConBlock SH is a penetrating sealer and not a coating, the surface characteristics are virtually unaffected.

Features and Benefits

- Reduces dusting
- Reduces porosity / absorbency
- Improves freeze / thaw scaling protection
- Increases chemical resistance
- Improves abrasion resistance

Physical Properties

Color:	Clear to slightly hazy liquid
Coverage:	125-200 SF/gallon
Odor:	None to slightly soapy
Density:	9.15 lbs/gal
pH:	11.5 to 12
VOC:	0 g/l

Product Testing

Scaling Resistance	ASTM C672 *Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals* After 50 cycles, ConBlock SH treated block showed minimal scaling compared to the control, which showed severe scaling.
Absorption	ASTM C642 *Standard Test Method for Density, Absorption, and Voids in Concrete* A 16% reduction in absorption after 7 days as compared to the control.
Crack Sealing	ODOT SS 841 *Proof of Crack Sealing Test (Modified AASHTO T259)* ConBlock SH passed with a rating of 8.8 with an average crack width of 0.002" (0.05mm).
Abrasion Resistance	ASTM D4060 *Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser* A reduction in mass loss of 53% after 1,000 cycles as compared to the control.

Directions for Use

Surface Preparation:
The concrete must be clean and free from dust, dirt, heavy wax, thick grease, recently applied surface sealer, acrylic paint and debris before application of ConBlock SH. Inspect surface for soundness. Repair or remove any surface irregularities and loose concrete, using an approved crack filling method on static hairline cracks. When the surface is clean, sound and dry, proceed with coating application.
Mixing: Stir thoroughly prior to use. Do not thin or dilute ConBlock SH.
Application: Apply ConBlock SH at an approximate rate of 125-250 square feet per gallon, depending upon the concrete's porosity. Low pressure spray equipment such as a hand pump garden sprayer works well for small to medium size areas. For larger areas, airless spray equipment is recommended. Do not allow ConBlock SH to pond or puddle, as a white residue will likely form on the surface of the concrete. On horizontal surfaces, move the excess material from the low spots to the high spots with a squeegee. A broom, paint roller or microfiber pad can be used to spread out areas that puddle to prevent over application.
Curing: The concrete will normally be dry in 4 hours and can be open to use. Do not allow the concrete to get wet for 18 hours after application for optimum performance. Full cure will take up to 28 days.

DO NOT SUBJECT CONBLOCK SH TO FREEZING TEMPERATURES

Version: 29-Jan-20

CONCRETE SEALANTS INC. ■ 9325 State Route 201 ■ Tipp City, OH 45371, USA ■ **www.ConSeal.com**
Toll Free (USA): 800.332.7325 ■ **Phone:** +1.937.845.8776 ■ **Fax:** +1.937.845.3587

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ConSeal™
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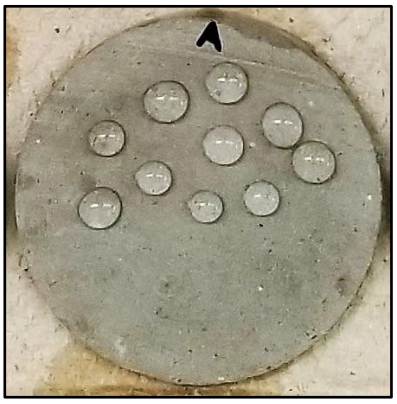
BOND OF TRUST
Don't Just Seal It, ConSeal It!

ConBlock Topical™

Water-repelling Concrete Sealer



Water-repelling Penetrating Sealer Fortified with ConBlock™ MIC

Applications

Penetrating water repelling sealer that is applied topically to concrete to block the absorption of moisture. Additionally, ConBlock Topical contains ConBlock MIC, an EPA-registered antimicrobial, to protect the sealer from becoming compromised by mold, fungus, algae and some acid producing bacteria. ConBlock Topical prevents Microbial Induced Corrosion (MIC) of concrete. Perfect for shady, damp areas where concrete can become discolored from environmental contaminants. ConBlock Topical reduces the absorption of liquids on concrete keeping the concrete cleaner. Prevents damage from aggressive liquids such as chlorides or sugar water.

Performance Properties

- Prevents microbial induced corrosion
- Prevents attack from chlorides, sugar water
- Reduces absorption of staining liquids
- Prevents above grade concrete discoloration
- Safe for indoor/outdoor application
- Recommended for sanitary sewer environments such as septic tanks, manholes, reinforced concrete pipes

Physical Properties and Chemical Composition

Drying Time:	<15 minutes
VOC Content:	0 g/L
Solids Content:	1-5
Coverage:	150-200 square feet/gallon
Shelf Life:	One-year, unopened container
pH:	3.0-4.5
Density:	8.0-9.0 lb./gallon
Color:	Clear, Tinted

Directions for Use

Surface Preparation:
The concrete must be clean and free from dust, dirt, heavy wax, thick grease, recently applied surface sealer, acrylic paint and debris before application of ConBlock Topical. Inspect surface for soundness. Repair or remove any surface irregularities and loose concrete, using an approved crack filling method on static hairline cracks. When the surface is clean, sound and dry, proceed with coating application.

Mixing:
Stir thoroughly prior to use. Do not thin or dilute ConBlock Topical.

Application:
Apply ConBlock Topical at an approximate rate of 150-200 square feet per gallon, depending upon the concrete's porosity. A sponge mop, paint roller or microfiber pad can be used to apply the material.

DO NOT SUBJECT CONBLOCK TOPICAL TO FREEZING TEMPERATURES

Limited Warranty

This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufactures in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the **users' responsibility** to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.

Version: 29-Jan-20

CONCRETE SEALANTS INC. ■ 9325 State Route 201 ■ Tipp City, OH 45371, USA ■ **www.ConSeal.com**
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Appendix D

Test Panel Concept Plan

BUREAU OF RECLAMATION

Test Panel Concept Plan

Algae Resistant Linings for Canals and Other Water Resources Structures Project
Quincy Columbia Basin Irrigation District, Washington
Pacific Northwest Region

Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

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

Contents

Scope of Work

Eight concrete panels measuring 2 ft x 2ft x 3.5 in will be cast on site and will cure for 28 days. They will then be transported and lowered into W44 canal to determine their performance against algae growth. Inspections will take place weekly with documentation shared with Concrete and Structural Laboratory, in Denver, Colorado.

1 Preparations

1.1 Location

Warehouse within Quincy Columbia Basin Irrigation District office grounds.

1.2 Personnel

Representatives from the Quincy Columbia Irrigation District (QBCID) and Concrete and Structural Laboratory (CSL) will be present to oversee and participate in the operation. CSL members will conduct the testing of the concrete's fresh properties.

1.3 Job Hazard Analysis (JHA)

A Job Hazard Analysis (JHA) will be reviewed and signed by all involved on site. The document will include basic information such as scope of work, Personal Protective Equipment (PPE) required, in case of emergency contact lists, etc. A copy can be found in Appendix XX.

1.4 Concrete

4 cubic yards of concrete will be delivered to the site by Central Washington Concrete ready mix company. The specifications of the ordered concrete will comply to the specifications of QCBID listed in Section F (Appendix XX).

A small X mixer will be available on site to make modifications for each slab prior to placement.

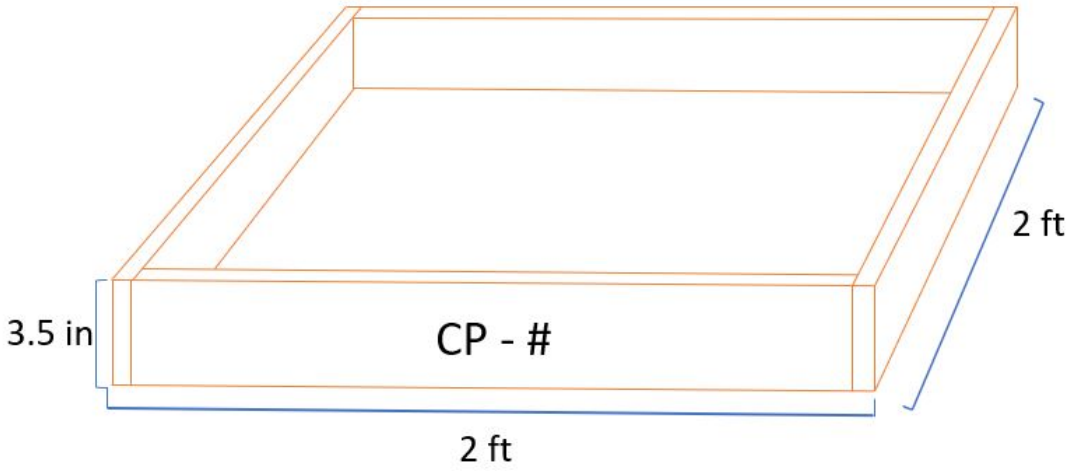
1.5 Testing Panels

The following chart shows the mixes to be made and the denomination for each.

Panel ID	Modification	Remarks
CP-1	N/A	Control panel
CP-2	Admixture #1	TBD
CP-3	Admixture #2	TBD
CP-4	Admixture #3	TBD
CP-5	Krystal Internal Membrane (KIM)	-
CP-6	Copper Slag #1	Medium (20/50)
CP-7	Copper Slag #2	Fine (30/60)
CP-8	Smoother finish	Finish desired - F4

1.5.1 Forms

Forms will be assembled with 2x4 construction and silicone caulked at the seams.



Each assembled form will need to be labeled using the Panel ID as shown in Section 2.5.

Form oil is to be applied to the surface of the form to ensure proper release at time of removal.

Forms are to be placed on a level, stable surface or base such as pallets.

1.5.2 Anchors

Sixteen, thread-in anchor bolts are to be cast in place. Accompanying expansion bolts will be drilled into bolts after the panels have cured for 28 days and have been demolded. ** Barbara currently determining type, size, edge distance, etc.

1.6 Miscellaneous Equipment and Materials

A vibrator will be on site for consolidation of concrete.

A plastic lined dumpster and/or a concrete washout are necessary to properly dispose of any excess concrete and debris.

CSL will arrange delivery of modification materials (admixtures and aggregates) and any other testing equipment necessary (air pot, slump cone, etc.) to the site.

2 Mix Day Details

2.1 Fresh Concrete Testing

The tests to be performed are temperature, air, slump and making of concrete specimens in the field. CSL members will conduct the fresh properties testing of the first wheelbarrow. The concrete will be tested seven more times for each panel after modifications to their respective mix are made. Three (3) 4in x 8in specimens will be cast per modified mix, totaling a number of 24 cylinders. A member from QCBID will deliver the specimens to the local testing facility for testing after a period of 48 hours has elapsed.

Results need to comply with the following targets

Test	Target
Air Content (%)	4 to 6
Slump When Placed (in)	3
Slump When First Mixed (in)	4

2.2 Mix Modifications, Placement and Finishing

Concrete will be modified for each panel with the exception of the control panel and the F4 finish panel. Modifications for the remaining six panels will be done by using the small mixer prior to placing in the forms.

The modified concrete mix will then be discharged, and after testing, it can be placed into the forms as one lift with vibration for consolidation.

The mixer must be washed after each modification by spraying water. Any concrete excess is to be disposed of in a plastic lined dumpster.

Finishing – float finish on all but one. Trowel finish on the one remaining panel.

2.3 Curing and Form Removal

Place dampened terry cloth and plastic to cover forms and accompanying cylinders completely.

The slabs will need to be monitored throughout the 28 day curing period for room temperature, and moisture conditions of the cloth.

Forms can be removed at 28 days and mark each panel with their respective Panel ID.

3 Attachment to Canal and Inspection

3.1 Transportation

3.2 Attachment to Canal

**Need to determine what equipment is available to lower panels into canal (for example, forklifts, tractor, truck wench, etc)
**Working on determining just how would we lower them and pull them up for inspections.
**Barbara is looking into Hiliti catalogs and working with our shop crew to brainstorm ideas

3.3 Inspections

Inspections are to occur weekly using the form in Appendix XX. Upon completing inspection, form is to be scanned and emailed to CSL.

Appendix E

Concrete Test Reports

Test Cylinders		
		WESTERN PACIFIC ENGINEERING & SURVEY **Description:** Here is a picture of a cylinder from the 4th, 5th and 6th set.
WPES Project No. 20616	February 20th, 2020	Photo #1

Test Cylinders		
		WESTERN PACIFIC ENGINEERING & SURVEY **Description:** Picture of a cylinder from the 6th set. Note the chunks of additive on the surface of the cylinder.
WPES Project No. 20616	February 20th, 2020	Photo #2

Test Cylinders		
		WESTERN PACIFIC ENGINEERING & SURVEY **Description:** This is a picture of the broken cylinder from the 6th set. Notice the crystallized additive.
WPES Project No. 20616	February 20th, 2020	Photo #3

WESTERN PACIFIC ENGINEERING & SURVEY
1328 E. Hunter Place, Moses Lake, Washington
T: (509)765-1023 F: (509)765-1298

A2LA ACCREDITED # 4142.01

Concrete Field and Compression Test Report

Report To: QCBID
Attn: Craig Gyselink
P.O. Box 188
Quincy WA 98848

Placement Date: 2-13-2020
Project #: 20616
Report #: 01

Project Name: QCBID: Concrete Test Slabs
Contractor: QCBID
Placement Location: Test Slabs
Specimens Cast By: Ashley Lewis and Matt Maygren
Remarks:

Weather: Partly Cloudy
Air Temp. °F: 47
Size of Pour: 4 Cu. Yards

Truck #	1	Ex. Tests	Ex. Tests
Time	9:58AM		
Ticket Number	9048764		
Concrete Temperature, °F	60		
Slump, Inches	4		
Entrained Air, %	3.8		
Yield, Cubic Yards	N/A		
Specimen Set Number	301		
Number of Cylinders Cast	5		

Field Tests per ASTM Procedures: C31, C138, C143, C172, C231, C1064

Curing Information:

Curing Method: Standard
Initial Cure:
Final Cure: Water tank complying w/C511
Max/Min Temperatures, °F: 60-70

Concrete Mix Information:

Concrete Supplier: CWC (Othello)
Mix Design Code/Name: 4000 PSI 3/4" EX
Mix Design: 4000 PSI 3/4" EX
Design Strength: 4000 psi @ 28 days
Spec. Strength 4000
Design Slump: 4 in

Type of Cement: II
Additive: MBAE90 Amount, oz: 10
Additive: POZZ-80 Amount, oz: 78
Additive: DELVO Amount, oz: 64
Water Added On-Site: 0 gal

Concrete Compressive Strength Information:

Cylinder No.	Average Diam. (in)	Area (in^2)	Max. Load (lbs)	Stength (psi)	Age (days)	Fracture Type	Break Date	Tech Initials
301 A	4	12.566371	52075	4140	7	III	2/20/2020	JAG
301 B	4	12.566371	76710	6100	28	III	3/12/2020	JAG
301 C	4	12.566371	76360	6080	28	III	3/12/2020	JAG
301 D	4	12.566371	88120	7010	56	III	4/9/2020	JAG
301 E	4	12.566371	88140	7010	56	III	4/9/2020	JAG

In-Lab Strength Tests per ASTM Procedures: C39

These test results relate only to the items tested.

Respectfully Submitted: Julio Gonzalez

WESTERN PACIFIC ENGINEERING & SURVEY
1328 E. Hunter Place, Moses Lake, Washington
T: (509)765-1023 F: (509)765-1298

A2LA ACCREDITED # 4142.01

Concrete Field and Compression Test Report

Report To: QCBID
Attn: Craig Gyselink
P.O. Box 188
Quincy WA 98848

Placement Date: 2-13-2020
Project #: 20616
Report #: 03

Project Name: QCBID: Concrete Test Slabs
Contractor: QCBID
Placement Location: Test Slabs
Specimens Cast By: Ashley Lewis and Matt Maygren
Remarks:

Weather: Partly Cloudy
Air Temp. °F: 47
Size of Pour: 4 Cu. Yards

Truck #	1	Ex. Tests	Ex. Tests
Time	9:58am		
Ticket Number	9048764		
Concrete Temperature, °F	55		
Slump, Inches	3.75		
Entrained Air, %	3.8		
Yield, Cubic Yards	N/A		
Specimen Set Number	303		
Number of Cylinders Cast	5		

Field Tests per ASTM Procedures: C31, C138, C143, C172, C231, C1064

Curing Information:

Curing Method: Standard
Initial Cure:
Final Cure: Water tank complying w/C511
Max/Min Temperatures, °F: 60-70

Concrete Mix Information:

Concrete Supplier: CWC (Othello)
Mix Design Code/Name: 4000 PSI 3/4" EX
Mix Design: 4000 PSI 3/4" EX
Design Strength: 4000 psi @ 28 days
Spec. Strength 4000
Design Slump: 4 in

Type of Cement: II
Additive: MBAE90 Amount, oz: 10
Additive: POZZ-80 Amount, oz: 78
Additive: DELVO Amount, oz: 64
Water Added On-Site: 0 gal

Concrete Compressive Strength Information:

Cylinder No.	Average Diam. (in)	Area (in^2)	Max. Load (lbs)	Stength (psi)	Age (days)	Fracture Type	Break Date	Tech Initials
303 A	4	12.566371	51005	4060	7	II	2/20/2020	JAG
303 B	4	12.566371	78420	6240	28	III	3/12/2020	JAG
303 C	4	12.566371	77880	6200	28	III	3/12/2020	JAG
303 D	4	12.566371	91285	7260	56	III	4/9/2020	JAG
303 E	4	12.566371	91285	7260	56	V	4/9/2020	JAG

In-Lab Strength Tests per ASTM Procedures: C39

These test results relate only to the items tested.

Respectfully Submitted: Julio Gonzalez

WESTERN PACIFIC ENGINEERING & SURVEY
1328 E. Hunter Place, Moses Lake, Washington
T: (509)765-1023 F: (509)765-1298

A2LA ACCREDITED # 4142.01

Concrete Field and Compression Test Report

Report To: QCBID
Attn: Craig Gyselink
P.O. Box 188
Quincy WA 98848

Placement Date: 2-13-2020
Project #: 20616
Report #: 02

Project Name: QCBID: Concrete Test Slabs
Contractor: QCBID
Placement Location: Test Slabs
Specimens Cast By: Ashley Lewis and Matt Maygren
Remarks: Not enough sample was made to do the Slump or Air Test. 3 cylinders where cast with what was left of sample for a 7, 28, and 56 day break.

Weather: Partly Cloudy
Air Temp. °F: 47
Size of Pour: 4 Cu. Yards

Truck #	1	Ex. Tests	Ex. Tests
Time	9:58		
Ticket Number	9048764		
Concrete Temperature, °F			
Slump, Inches			
Entrained Air, %			
Yield, Cubic Yards	N/A		
Specimen Set Number	302		
Number of Cylinders Cast	3		

Field Tests per ASTM Procedures: C31, C138, C143, C172, C231, C1064

Curing Information:

Curing Method: Standard
Initial Cure:
Final Cure: Water tank complying w/C511
Max/Min Temperatures, °F: 60-70

Concrete Mix Information:

Concrete Supplier: CWC (Othello)
Mix Design Code/Name: 4000 PSI 3/4" EX
Mix Design: 4000 PSI 3/4" EX
Design Strength: 4000 psi @ 28 days
Spec. Strength 4000
Design Slump: 4 in

Type of Cement: II
Additive: MBAE90 Amount, oz: 10
Additive: POZZ-80 Amount, oz: 78
Additive: DELVO Amount, oz: 64
Water Added On-Site: 0 gal

Concrete Compressive Strength Information:

Cylinder No.	Average Diam. (in)	Area (in^2)	Max. Load (lbs)	Stength (psi)	Age (days)	Fracture Type	Break Date	Tech Initials
302 A	4	12.566371	50685	4030	7	II	2/20/2020	JAG
302 B	4	12.566371	74630	5940	28	III	3/12/2020	JAG
302 C	4	12.566371	83770	6670	56	V	4/9/2020	JAG

In-Lab Strength Tests per ASTM Procedures: C39

These test results relate only to the items tested.

Respectfully Submitted: Julio Gonzalez

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Concrete Field and Compression Test Report

Report To: QCBID
Attn: Craig Gyselink
P.O. Box 188
Quincy WA 98848

Placement Date: 2-13-2020
Project #: 20616
Report #: 04

Project Name: QCBID: Concrete Test Slabs
Contractor: QCBID
Placement Location: Test Slabs
Specimens Cast By: Ashley Lewis and Matt Maygren
Remarks:

Weather: Partly Cloudy
Air Temp. °F: 47
Size of Pour: 4 Cu. Yards

Truck #	1	Ex. Tests	Ex. Tests
Time	9:58am		
Ticket Number	9048764		
Concrete Temperature, °F	57		
Slump, Inches	3.25		
Entrained Air, %	3.7		
Yield, Cubic Yards	N/A		
Specimen Set Number	304		
Number of Cylinders Cast	5		

Field Tests per ASTM Procedures: C31, C138, C143, C172, C231, C1064

Curing Information:

Curing Method: Standard
Initial Cure:
Final Cure: Water tank complying w/C511
Max/Min Temperatures, °F: 60-70

Concrete Mix Information:

Concrete Supplier: CWC (Othello)
Mix Design Code/Name: 4000 PSI 3/4" EX
Mix Design: 4000 PSI 3/4" EX
Design Strength: 4000 psi @ 28 days
Spec. Strength 4000
Design Slump: 4 in

Type of Cement: II
Additive: MBAE90 Amount, oz: 10
Additive: POZZ-80 Amount, oz: 78
Additive: DELVO Amount, oz: 64
Water Added On-Site: 0 gal

Concrete Compressive Strength Information:

Cylinder No.	Average Diam. (in)	Area (in^2)	Max. Load (lbs)	Stength (psi)	Age (days)	Fracture Type	Break Date	Tech Initials
304 A	4	12.566371	52450	4170	7	III	2/20/2020	JAG
304 B	4	12.566371	77250	6150	28	III	3/12/2020	JAG
304 C	4	12.566371	79530	6330	28	III	3/12/2020	JAG
304 D	4	12.566371	86745	6900	56	III	4/9/2020	JAG
304 E	4	12.566371	89155	7090	56	III	4/9/2020	JAG

In-Lab Strength Tests per ASTM Procedures: C39

These test results relate only to the items tested.

Respectfully Submitted: Julio Gonzalez

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Concrete Field and Compression Test Report

Report To: QCBID
Attn: Craig Gyselink
P.O. Box 188
Quincy WA 98848

Placement Date: 2-13-2020
Project #: 20616
Report #: 06

Project Name: QCBID: Concrete Test Slabs
Contractor: QCBID
Placement Location: Test Slabs
Specimens Cast By: Ashley Lewis and Matt Maygren
Remarks: Sample was still soft after 24hrs of initial cure. Left in molds submerged in water for 6 days. When removed from the mold the admixture was highly visible. When broken, chunks of crystalized admixture

Weather: Partly Cloudy
Air Temp. °F: 47
Size of Pour: 4 Cu. Yards

Truck #	1	Ex. Tests	Ex. Tests
Time	9:58am		
Ticket Number	9048764		
Concrete Temperature, °F	58		
Slump, Inches	2.5		
Entrained Air, %	4		
Yield, Cubic Yards	N/A		
Specimen Set Number	305		
Number of Cylinders Cast	5		

Field Tests per ASTM Procedures: C31, C138, C143, C172, C231, C1064

Curing Information:

Curing Method: Standard
Initial Cure:
Final Cure: Water tank complying w/C511
Max/Min Temperatures, °F: 60-70

Concrete Mix Information:

Concrete Supplier: CWC (Othello)
Mix Design Code/Name: 4000 PSI 3/4" EX
Mix Design: 4000 PSI 3/4" EX
Design Strength: 4000 psi @ 28 days
Spec. Strength 4000
Design Slump: 4 in

Type of Cement: II
Additive: MBAE90 Amount, oz: 10
Additive: POZZ-80 Amount, oz: 78
Additive: DELVO Amount, oz: 64
Water Added On-Site: 0 gal

Concrete Compressive Strength Information:

Cylinder No.	Average Diam. (in)	Area (in^2)	Max. Load (lbs)	Stength (psi)	Age (days)	Fracture Type	Break Date	Tech Initials
305 A	4	12.566371	27570	2190	7	III	2/20/2020	JAG
305 B	4	12.566371	66430	5290	28	III	3/12/2020	JAG
305 C	4	12.566371	67260	5350	28	III	3/12/2020	JAG
305 D	4	12.566371	82345	6550	56	III	4/9/2020	JAG
305 E	4	12.566371	80035	6370	56	III	4/9/2020	JAG

In-Lab Strength Tests per ASTM Procedures: C39

These test results relate only to the items tested.

Respectfully Submitted: Julio Gonzalez

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Concrete Field and Compression Test Report

Report To: QCBID
Attn: Craig Gyselink
P.O. Box 188
Quincy WA 98848

Placement Date: 2-13-2020
Project #: 20616
Report #: 05

Project Name: QCBID: Concrete Test Slabs
Contractor: QCBID
Placement Location: Test Slabs
Specimens Cast By: Ashley Lewis and Matt Maygren
Remarks:

Weather: Partly Cloudy
Air Temp. °F: 47
Size of Pour: 4 Cu. Yards

Truck #	1	Ex. Tests	Ex. Tests
Time	9:58am		
Ticket Number	9048764		
Concrete Temperature, °F	57		
Slump, Inches	2.75		
Entrained Air, %	3.2		
Yield, Cubic Yards	N/A		
Specimen Set Number	305		
Number of Cylinders Cast	5		

Field Tests per ASTM Procedures: C31, C138, C143, C172, C231, C1064

Curing Information:

Curing Method: Standard
Initial Cure:
Final Cure: Water tank complying w/C511
Max/Min Temperatures, °F: 60-70

Concrete Mix Information:

Concrete Supplier: CWC (Othello)
Mix Design Code/Name: 4000 PSI 3/4" EX
Mix Design: 4000 PSI 3/4" EX
Design Strength: 4000 psi @ 28 days
Spec. Strength 4000
Design Slump: 4 in

Type of Cement: II
Additive: MBAE90 Amount, oz: 10
Additive: POZZ-80 Amount, oz: 78
Additive: DELVO Amount, oz: 64
Water Added On-Site: 0 gal

Concrete Compressive Strength Information:

Cylinder No.	Average Diam. (in)	Area (in^2)	Max. Load (lbs)	Stength (psi)	Age (days)	Fracture Type	Break Date	Tech Initials
305 A	4	12.566371	54880	4370	7	III	2/20/2020	JAG
305 B	4	12.566371	79910	6360	28	III	3/12/2020	JAG
305 C	4	12.566371	80610	6410	28	III	3/12/2020	JAG
305 D	4	12.566371	93165	7410	56	III	4/9/2020	JAG
305 E	4	12.566371	92945	7400	56	III	4/9/2020	JAG

In-Lab Strength Tests per ASTM Procedures: C39

These test results relate only to the items tested.

Respectfully Submitted: Julio Gonzalez

WESTERN PACIFIC ENGINEERING & SURVEY
1328 E. Hunter Place, Moses Lake, Washington
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ACCREDITED # 4142.01

Concrete Field and Compression Test Report

Report To: Quincy Columbia Basin Irrigation District
Attn: Dee Kukes
PO Box 188
Quincy, WA 98848

Placement Date: 3/18/21
Project #: 21619
Report #: 1

Project Name: Columbia Basin Irrigation Distict
Contractor: Columbia Basin Irrigation Distict
Placement Location: Testing Location
Specimens Cast By: Scott Henson
Remarks:

Weather: Clear
Air Temp.: 61 °F
Size of Pour: 4 Cu. Yards

Truck #		Ex. Tests	Ex. Tests
Time	9:10		
Ticket Number	9052856		
Agg. Correction Factor	n/a		
Concrete Temperature, °F	75		
Slump, Inches	1.5		
Entrained Air, %	2.7		
Corrected Air Content	n/a		
Yield, Cubic Yards	n/a		
Specimen Set Number	801		
Number of Cylinders Cast	5		

Field Tests per ASTM Procedures: C31, C138, C143, C172, C231, C1064

Curing Information:

Curing Method: Standard
Initial Cure: type
Final Cure: type
Max/Min Temperatures, °F: 81/64

Test results relate only to the items tested.

Concrete Mix Information:

Concrete Supplier: CWC (Moses Lake)
Mix Design Code/Name: Master Driveway
Mix Design: Master Driveway
Design Strength: N/A psi @ 28 days
Spec. Strength N/A
Design Slump: 4 in

Type of Cement: I
Additive: Amount, oz:
Additive: Amount, oz:
Additive: Amount, oz:
Water Added On-Site: gal

Concrete Compressive Strength Information:

Cylinder No.		Average Diam. (in)	Area (in^2)	Max. Load (lbs)	Stength (psi)	Age (days)	Fracture Type	Break Date	Tech Initials
801	A	4.01	12.629281	63625	5040	7	V	3/25/2021	MM
801	C	4.01	12.629281	85135	6740	28	III	4/15/2021	DD
801	D	4.01	12.629281	85525	6770	28	III	4/15/2021	DD
801	E	4.01	12.629281	80015	6340	28	III	4/15/2021	DD
801	EX					EX			

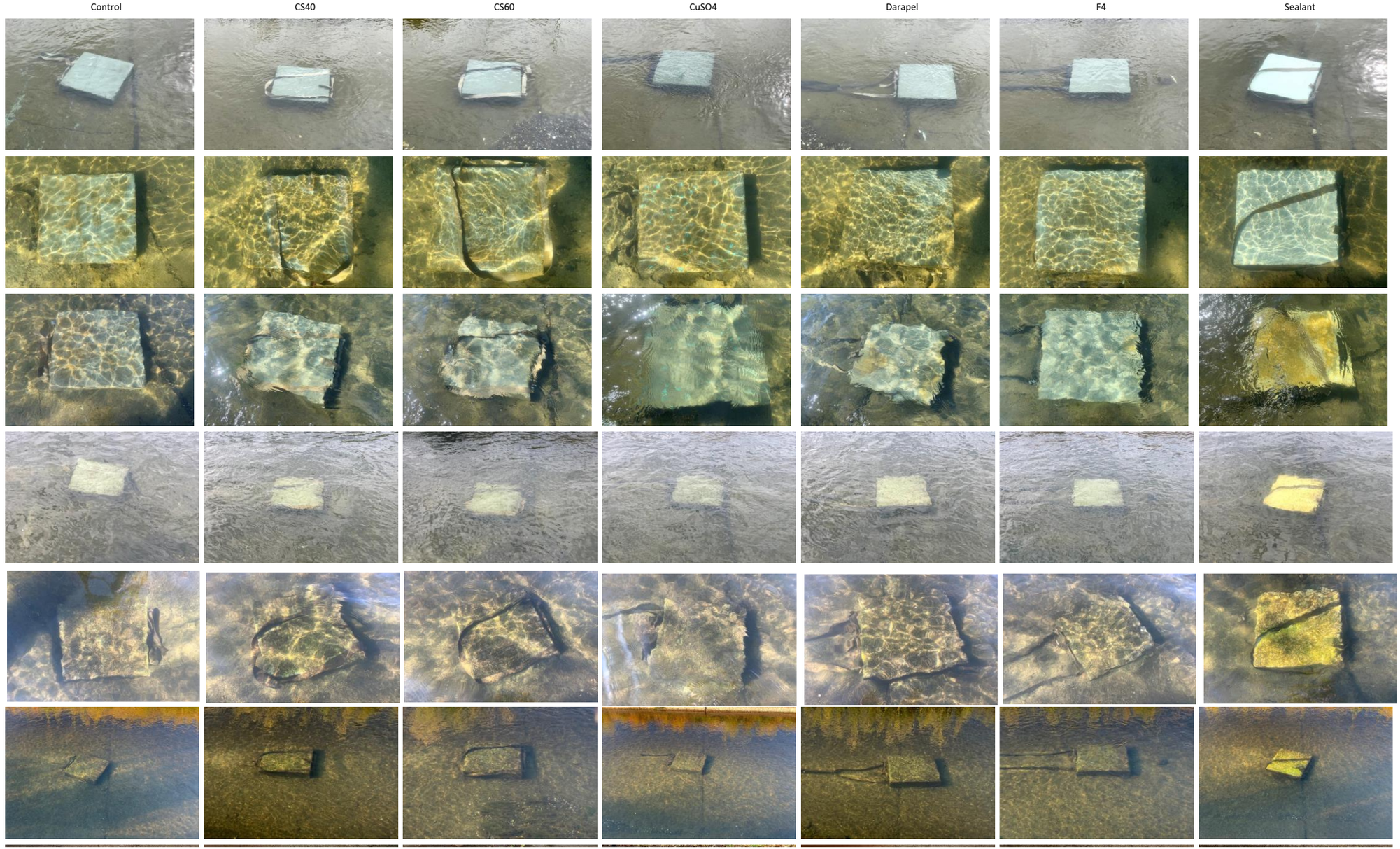
In-Lab Strength Tests per ASTM Procedures: C39

Engineer: Nathan Nofziger, P.E.

Respectfully Submitted: David Dekker

Appendix F

2020 Concrete Panel Photographs

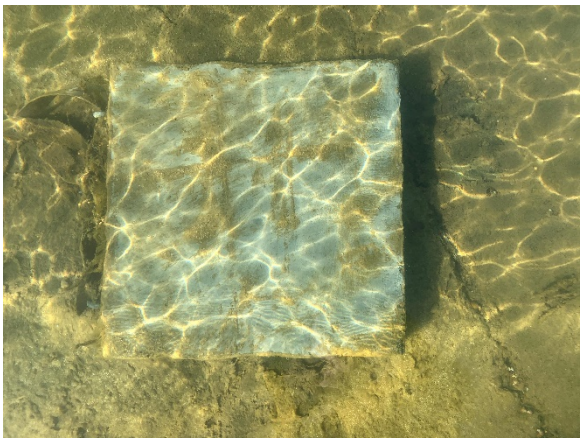

Control
CS40
CS60
CuSO4
Darapel
F4
Sealant
4/1/2020
5/4/2020
6/1/2020
7/1/2020
8/3/2020
8/31/2020

9/25/2020

10/14/2020

10/14/2020 Out of Water

Control Panel



May 2020

June 2020

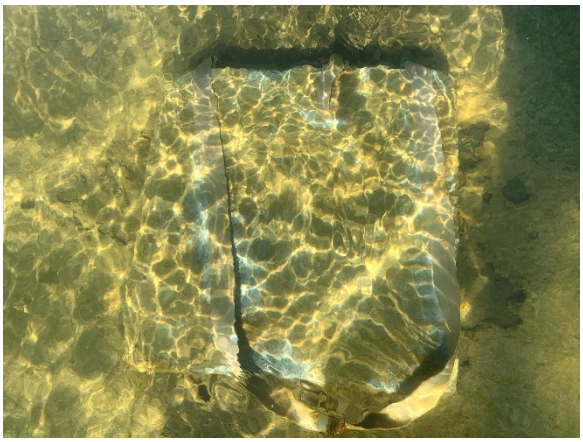
July 2020

August 2020

September 2020

October 2020

Copper Slag 40



May 2020

June 2020

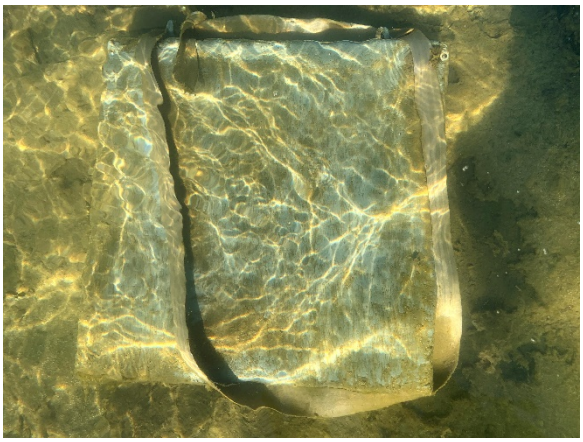
July 2020

August 2020

September 2020

October 2020

Copper Slag 60



May 2020

June 2020

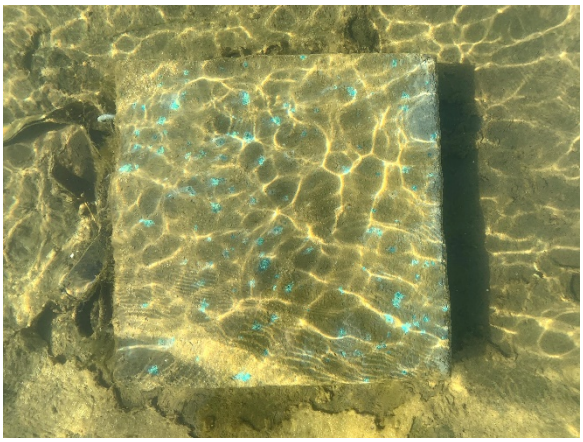
July 2020

August 2020

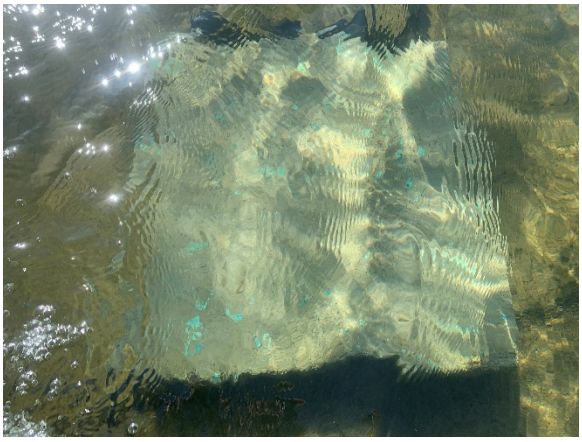
September 2020

October 2020

Copper Sulfate



May 2020



June 2020

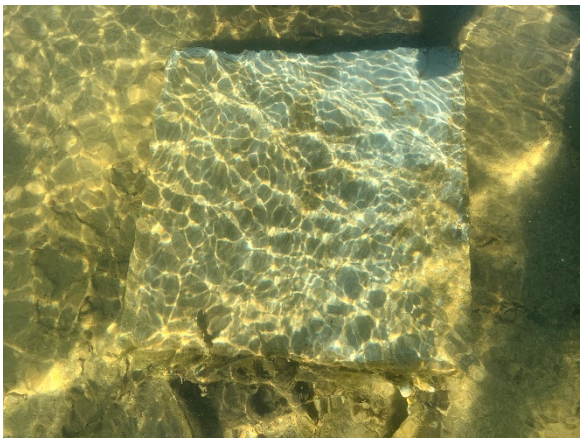
July 2020

August 2020

September 2020

October 2020

Darapel



May 2020

June 2020

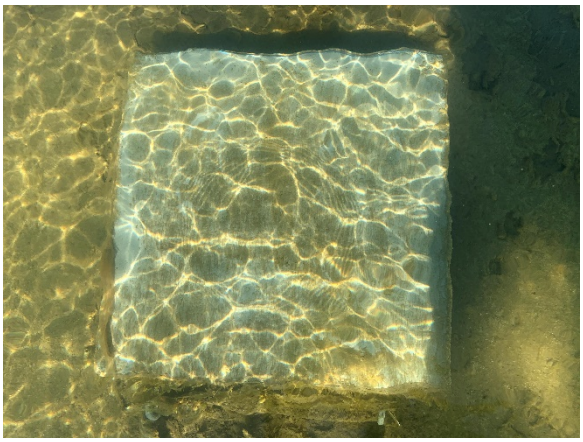
July 2020

August 2020

September 2020

October 2020

Troweled Finish (F4)



May 2020

June 2020

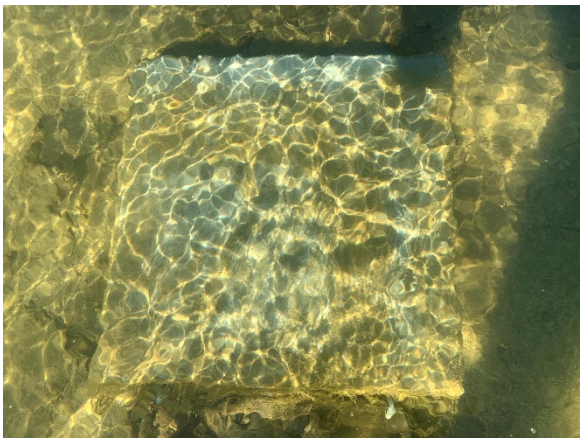
July 2020

August 2020

September 2020

October 2020

Force 10,000



May 2020

No pictures were taken for the Force 10,000 panels in June.

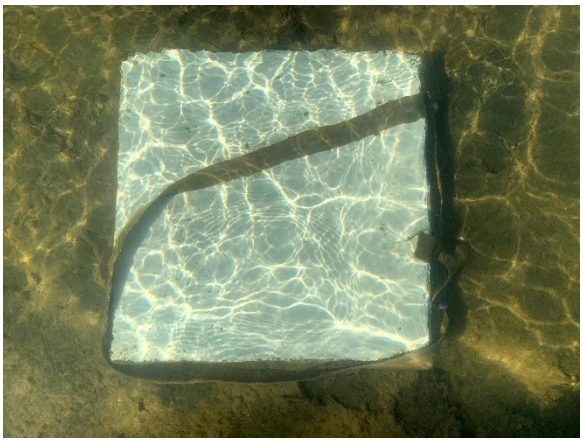
July 2020

August 2020

September 2020

October 2020

Loxon Sealer



May 2020

June 2020

July 2020

August 2020

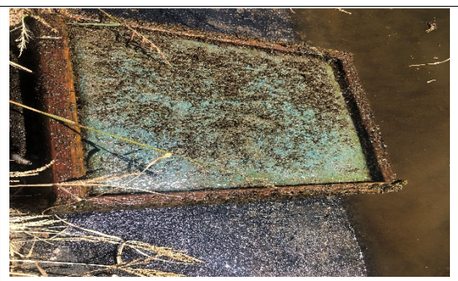
September 2020

October 2020

Appendix G

2021 Concrete Panel Photographs

Panel 1 Control	Panel 2 SH Sealer	Panel 3 Topical	Panel 4 Combo of SH sealer and Topical	Panel 5 Loxon and topical
05/21/2021 Temp was 60 degrees				
				
6/21/2021 Temp was 68 degrees				
				
07/16/2021 Temp was 71 degrees				
				
08/17/2021Temp was 70 degrees				
				

09/03/2021 Temp was 71 degrees				
				
09/21/2021 Temp was 68 degrees				
				
10/08/2021 Temp was about 55 degrees				
				
10/22/2021 Temp was about 50 degrees