



SUBCONTRACTOR BID FORM - 10.10.2014 Revision

Office: 520-207-8228 | Fax 623-582-3761
1904 W. Prince Rd., Tucson, AZ 85705
www.bfcontracting.com | License # AZ ROC-089744

To: B&F Contracting, Inc.

From: SAK Construction, LLC

864 Hoff Road, O'Fallon, MO 63366

Phone: 636-385-1000

Email: bhirtz@sakcon.com

RE: Construction Manager at Risk Services for North Rillito Interceptor Rehabilitation
Pima County Project No. 3NRI14

Subject: Bid Due Date: Monday 10/13/2014
Time: 3:00 PM
Location: B&F Tucson Office
1904 W. Prince Rd., Tucson, AZ

General Information:

B&F Contracting, Inc., acting as the CM@Risk Contractor is requesting proposals from approved contractors interested in furnishing subcontractor services for the project.

Plan Availability:

Electronic Copies of Project drawings and Specifications will be available for pickup at the B&F Tucson Office

**Bids will be received and opened privately by B&F with PCRWRD

1 Special Instructions to Bidders

- 1.01 Instruction to Bidders are provided for the purpose of clarifying the Subcontractor Bid Form. Each prospective Bidder shall review the below instructions and all documents prior to submission of their respective bid.
- 1.02 If prospective bidder elects not to bid, please inform B&F Contracting Inc. in writing immediately via fax or email.
- 1.03 Bids can be submitted electronically (dfoley@bfcontracting.com or tomf@bfcontracting.com), fax (623.582.3761) or hand delivered at the B&F Tucson Office by 3:00 PM Arizona time Monday October 13, 2014, located at 1904 W. Prince Rd., Tucson, AZ.
- 1.04 Any bids received after 3:00 PM on October 13, 2014 will be considered non-responsive and not be read at the bid opening. Telephone bids will not be accepted, email or fax bids are acceptable. Fax bids will be sent to 623.582.3761. If the bidding contractor elects to fax or email their bid it will be their responsibility to call and confirm receipt of your faxed or emailed bid before the bid due time.
- 1.05 Any and all questions related to this bid shall be directed in writing via email to Dan Foley at the email addresses listed above. The last day for questions to be answered will be Friday October 3, 2014.
- 1.06 Bids are required to be submitted on the 'Subcontractor Bid Form'. Please insert N/A on bid items outside your scope.
- 1.07 Receipt and review of Addenda and/or Amendments shall be acknowledged by the Bidders on their completed Subcontractor Bid Form.
- 1.08 B&F to provide electronic copies of plans, specifications, as-builts, pre-videos, inspection reports, etc., to bidding contractors on usb flash drive. Bidding contractors to return flash drives after bid period is complete.
- 1.09 Pima County Regional Wastewater Reclamation Department and B&F Contracting reserve the right to accept or reject any and/or all Bids.
- 1.10 Pima County Regional Wastewater Reclamation Department and B&F Contracting reserve the right to waive any informality in any Bid.
- 1.11 Prospective bidders are to refrain from contacting the Owner or Designer with questions regarding the Bid. All questions are to be directed to B&F Contracting, Inc.
- 1.12 Bids received after the bid due date/time will not be considered. Any bid modification received after the bid date/time will not be considered.
- 1.13 Contractor selection criteria for the rehabilitation work will be based on the following criteria; Price, Qualifications and Schedule.

- 1.14 The bidder assumes full responsibility for timely delivery at the location specified for receipt of bids.
- 1.15 Bids which modify any of the provisions of the Bidding or Contract documents will not be considered.
- 1.16 A Bid that is in the possession of B&F Contracting Inc. may be withdrawn by the bidder up to the time of the bid opening.
- 1.17 Each Bidder shall provide unit prices in accordance with the required Bid Schedule
- 1.18 Bid pricing shall include but is not limited to the following: Any and all costs for fabrication, delivery and expeditious delivery, layout, supervision, labor, materials, equipment, uncrating, setting, hoisting, installation, parking, storage, insurance, permits, engineering, supervision tools, payroll taxes, escalation, overhead, profit, shop drawings, submittals, samples, mock ups, overtime or weekend work and any other costs necessary to complete the work required in accordance with all associated project documents per the provided construction schedule.
- 1.19 Bid prices shall be based on earliest attainable delivery without incurring additional costs to the owner.
- 1.20 The successful Bidder will be notified only after a thorough review and evaluation of all the bids that have been made to the PCRWRD and B&F Contracting. Bid evaluations will be based on but not limited to: Scope, price qualifications and ability to meet the construction schedule. A post bid interview may also be required.
- 1.21 CIPP Lining Contractors are required to submit CIPP shot schedule with bid documents. Failure to submit CIPP shot schedule with the bid documents will result in the rejection of your bid proposal. Please include Reach I.D., Length, Thickness, Inversion/Tail MH's, Etc.
- 1.22 Each bidder shall include overtime rates/pricing into their bid. This project will have a 24/7 schedule with 7-day work weeks to meet the construction schedule provided with the bid documents. B&F will not accept additional costs for overtime rates.
- 1.23 CIPP & Manhole Contractors are to submit crew availability and quantities to B&F Contracting with their bid. A Microsoft Word document will be acceptable.
- 1.24 CIPP Lining & MH Rehab Contractors are to commit and maintain a single, consistent crew and foreman for each of the phases. The interchanging of crew and personnel from phase to phase will not be accepted on this project.
- 1.25 CIPP & Manhole Contractors are to submit a list including key personnel on the project (Superintendent & Project Manager) to B&F Contracting Inc. for review with the bid documents.
- 1.26 CIPP & Manhole Contractors are to submit a list showing your current workload in the Southwest Region, where crews specific to AZ are currently being utilized. Please list project name, size, schedule and crew commitments.
- 1.27 No more than 1 major intersection may be blocked at a time by either the CIPP, Manhole Rehab or Bypass Pumping contractor.
- 1.28 CIPP Lining contractors are to refrain and/or limit inversion in private properties where access is limited (i.e. backyard, driveway, landscaped areas) All manholes residing in these areas will need to be used as "Tail Manholes" or "Thru Manholes" for the liner.
- 1.29 Bypass Pumping for the NRI sewer flows and all incoming lateral flows will be handled by B&F Contracting. Please do not include these costs in your bid.
- 1.30 Manhole Rehab Contractor to provide and place their own plugs as required to complete their own scope of work, and to maintain a dry work environment.
- 1.31 It is B&F Contracting's intent to award the CIPP lining contract for the entire project to one (1) Contractor
- 1.32 Manhole Rehabilitation Contractor to verify that their product is on the PCRWRD's Approved Product List.
- 1.33 The MH Coating/Rehab work could possibly be split between two (2) contractors due to SBE/DBE Compliance with Pima County Procurement.
- 1.34 Temperature sensor cable to continuously monitor the cure temperature of CIPP liner along the entire length of pipe, to be provided by the CIPP contractor
- 1.35 MH Coating to provide sandbagging or plugging for nuisance water during all MH underlayment and Coating operations at each individual MH. B&F to provide all mainline flow management for 8-inch and larger flows, but cannot guarantee a completely dry manhole condition.
- 1.36 CIPP & Manhole Coating Contractors are required to field verify existing conditions of sewer and manhole diameters prior to bidding this project. It is expected that any variation from the B&F provided bid schedule be included within your unit cost. It is up to the bidding contractor to confirm existing sizes of the interceptor and manholes, and cross reference with the Pima County GIS System, As-Builts and MH Inspection Reports.
- 1.37 Manhole Coating Rehabilitation work includes, but is not limited to: Surface Preparation Work, Build-Back, Re-Work of Invert and/or Channels, Chipping, Demolition Re-Profiling and Corrosion Resistant Coatings as called out on the Manhole Inspection Report provided on the USB drive. Please pay attention to Brown & Caldwell's specific recommendations for repair at each manhole and include them with your VF pricing.
- 1.38 Please provide a list of your current workload in Arizona, Nevada and California with the assigned key personnel managing those projects.
- 1.39 B&F will require full time supervision from the MH Coating and CIPP Lining Contractors. It is a requirement to provide full time onsite supervision throughout the course of this project.

- 1.40 A pre-liner is required for CIPP Lining of existing Coated ACP sewer lines. B&F has provided initial quantities below on the bid schedule but the CIPP contractor is tasked with field verifying those quantities.
- 1.41 CIPP Lining & MH Coating Contractors are required to provide a Payment/Performance Bond on this project per Item 12 below. Please include this cost under the 'Bond' section of this bid for consideration (do not include in your unit cost).
- 1.42 Water Cure is the only acceptable curing/inversion method on this project. Air/Steam will not be accepted and is grounds for disqualification if included in your bid.
- 1.43 MH Rehabilitation/Coating Contractor to provide five (5) year warranty bond with their bid. Contractor to provide breakout pricing for this cost on the bottom of the bid schedule below (not in the VF unit pricing).
- 1.44 Lining Contractors to provide all styrene monitoring per the RWRD Specifications.
- 1.45 B&F to provide all new manhole frame/covers and concrete collars.
- 1.46 MH rehabilitation/Coating Contractor to pay close attention to new MH Coatings Specifications provided for this project. This specification is brand new for the county and has not been used in the past. Please review the revised cleaning, underlayment, finish and testing requirements outlined.
- 1.47 CIPP Lining Contractors are not to include costs for cleaning, pre and post video in your unit prices. B&F to provide. B&F expects the CIPP Lining Contractor to take part in the coordination and scheduling process for the clean/cctv subcontractor.
- 1.48 MH Coating Contractor to provide costs for removal of existing steps and replacement with new in their VF unit pricing on the bid schedule below.
- 1.49 MH Coating Contractor to remove any T-Lock as necessary at existing manholes.
- 1.50 CIPP Lining Contractor to provide all 'End Seals' using Neopoxy or similar product to complete their own scope of work
- 1.51 MH Coating Contractor scope of work includes coating of the invert to match the thickness of the CIPP Lining. Also include costs for coating and Tie-In to CIPP liner at "Lined Through Manholes" and "Tail End" with compatible product.
- 1.52 CIPP Lining contractor to provide their own construction water for CIPP lining operations, including, but not limited to; hydrant meters, piping, valves permits, water ramps, etc.. If any trenching is required for roadway crossings, please provide the areas and dimensions on an extra sheet with your bid.
- 1.53 CIPP Lining contractor to furnish and install hydrophilic seals between the host pipe and new CIPP Liner at each manhole.
- 1.54 MH 8716-04 to 8716-03 in Phase 1 has been previously CIPP lined on a recent project. Please do not include CIPP costs for this reach.
- 1.55 MH Coating contractor to review Sabino Creek Siphon Inlet & Outlet Structure As-built Drawings for rehabilitation and coating work at 4466-IN & 4466-OUT. Work scope includes, but is not limited to, cleaning, coating and new redwood diversion stop logs. B&F remove and replace existing concrete lids with new precast material that will need to be coated.
- 1.56 CIPP & MH Coating Contractors are to provide daily cleanup of the jobsite and manholes/reaches. It is expected for MH Contractors to cleanup all debris generated from cleaning, preparation and coating activities.
- 1.57 CIPP & MH Coating Contractor to provide a letter from your bonding company that you have the capacity to provide a payment/performance bond for this project.
- 1.58 Bidding Contractors to adhere to Pima County, 2012 Engineering Design Standards and Standard Specifications and Details for Construction 2012

2 Mandatory Pre-Bid Meeting

A Mandatory Pre-Bid Conference has been scheduled for 9/30/2014 at 10:00 am and will be held at the PCRWRD Conveyance Office located at 3355 N. Dodge Blvd., Tucson, AZ

3 Project Schedule:

Bid Documents available to Subcontractors	29-Sep-14
Mandatory Pre-Bid Meeting	30-Sep-14
Final Day for Questions	3-Oct-14
Bid Due Date	13-Oct-14
Bid Review	October 13 through October 17
Subcontractor Notification of Selection	17-Oct-14
Submittal Due Date	29-Oct-14
Notice to Proceed	5-Nov-14

4 North Rillito Interceptor - As-Builts

Electronic copies have been made available for the as-builts associated with the NRI Rehab Project. Please review these to verify shot lengths, dimensions, manhole sizes, structures, pipe materials and interior diameter prior to the bid and ordering of materials.

5 North Rillito Interceptor - Manhole Inspection Report

Electronic copies of the manhole inspection report have been made available to all potential MH & CIPP contractors prior to the bid. Please pay particular attention to the notes and photos of the manholes in regards to the condition of the existing channels and benches. The costs for rehabilitating these will need to be included in your VF price for manhole rehabilitation.

6 Flow Management Plans - Phase 1, 2, & 5

B&F will make available electronic copies of our flow management plans for Phase 1, 2 & 5, as they have been developed and approved at this point. The limits of Phases 3, 4 & 6 will be shown on a conceptual map. Phase 3 is tentatively from Sabino Canyon Rd. to Craycroft. Phase 4 Craycroft to Swan. Phase 6 is from Alvernon Way to Campbell Rd.

7 Project Sequence & Scheduling

This project will be broken into six (6) separate Rehabilitation Phases along the Rillito River. With the anticipation of each phase lasting 3-4 months for all rehabilitation and repair type work (New MH's, CIPP, Structures, Point Repairs, etc.). It is anticipated that there will be lags between each phases of roughly one (1) month to allow for the FMP installation, where there will be no CIPP or MH Rehab work taking place. See below for the phase limits:

Phase 1 - Woodland Rd. to the Sabino Creek

Phase 2 - Sabino Creek to 800' west of Sabino Canyon Rd.

Phase 3 - Sabino Canyon Rd. to Craycroft Rd.

Phase 4 - Craycroft Rd. to Swan Rd.

Phase 5 - Swan Rd. to Alvernon

Phase 6 - Alvernon to Campbell Rd.

Phase 1 Rehabilitation Section

This section encompasses the CIPP lining and Manhole Rehab work from (MH's 8716-20 to SIPHON 4466-IN). Approximately from Woodland Rd. to west of Tanque Verde Rd. ending at the Sabino Creek

Phase 2 Rehabilitation Section

This phase encompasses the CIPP Lining and Manhole Rehab work from MH's (4466-OUT to 1700-04). Approximately from the Sabino Creek to just west of Sabino Canyon Rd.

Phase 3 Rehabilitation Section

This phase encompasses the CIPP Lining and Manhole Rehab work from MH's (1700-04 to 5033-03). Approximately from west of Sabino Canyon Road to just west of Craycroft Rd.

Phase 4 Rehabilitation Section

This phase encompasses the CIPP Lining and Manhole Rehab work from MH's (5033-03 to 1712-01). Approximately from west of Craycroft Rd. to east of Swan Rd.

Phase 5 Rehabilitation Section

This phase encompasses the CIPP Lining and Manhole Rehab work from MH's (1712-01 to 1710-05). Approximately from east of Swan Rd. to Alvernon Way.

Phase 6 Rehabilitation Section

This phase encompasses the CIPP Lining and Manhole Rehab work from MH's (1710-05 to 8809-01). Approximately from Alvernon Way to west of Campbell Rd.

8 Bid Schedule

A. Phase 1 Rehabilitation Section - Woodland Rd to Sabino Creek Siphon (MH 8716-20 to 4466-IN)

Item Number & Description	Pipe Material	Quantity	Unit	Unit Price	Total
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CIPP LINING REHABILITATION - PHASE 1

1	Mobilization		1	LS	10,000.00	10,000.00
2	15" CIPP Lining (MH 8716-20 to 8716-10)	Coated ACP	5,100	LF	56.00	285,600.00
3	15" Pre-Liner for CIPP Lining	Coated ACP	5,100	LF	4.00	20,400.00
4	18" CIPP Lining (MH 8716-10 to MH 8716-02)	Coated ACP	3,009	LF	54.00	162,486.00
5	18" Pre-Liner for CIPP Lining	Coated ACP	3,009	LF	5.00	15,045.00
6	24" CIPP Lining (MH 8716-02 to 4466-IN)	VCP	416	LF	102.00	42,432.00

SUBTOTAL - CIPP LINING REHABILITATION **\$ 535,963.00**

MANHOLE REHABILITATION & COATING - PHASE 1

1	Rehabilitate & Coat Existing Manholes	181	VF	N/A	N/A
2	Rehabilitate & Coat Existing Base for MH Structural Inserts (MH 8716-05 & 8716-04)	2	EA	N/A	N/A
3	Coat New CIP MH Base for 72" Manhole Removal/Replacement (MH 8716-07, 8716-06, 8716-03)	3	EA	N/A	N/A
4	Specification Item E.3.1 - Efforts for cosmetic finish work to provide irregularity free uniform finish, free from trowel marks, voids, depressions, ripples, waves, bubbles, bumps or cracking in the final coating layer using an approved repair method. To provide uniform profile for coating.	120	HR	N/A	N/A
5	1-inch additional underlayment application for extremely deteriorated manholes	45	VF	N/A	N/A

SUBTOTAL - MH REHABILITATION & COATINGS **N/A**

****Please List Your Installation Days Required to Complete Your Own Scope of Work (Calendar Days):**

CIPP Lining **Sixteen (16)**

MH Coatings **N/A**

Please List any MH's That Require CIPP Inversion Access, Cone/Barrel Removals or Base Modifications Below:

None

NOTE: An inversion MH is the manhole that a shot is installed from. A tail MH is the manhole that a shot terminates at.

B. Phase 2 Rehabilitation Section - Sabino Creek Siphon to Sabino Creek Road (4466-OUT to 1700-04)

Item Number & Description	Pipe Material	Quantity	Unit	Unit Price	Total
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CIPP LINING REHABILITATION - PHASE 2

1	Mobilization		1	LS	10,000.00	10,000.00
2	21" CIPP Lining (1811-01A to MH 1700-16)	Coated ACP	278	LF	104.00	28,912.00
3	21" Pre-Liner for CIPP Lining	Coated ACP	278	LF	6.00	1,668.00
4	24" CIPP Lining (4466-OUT to 1811-01A)	VCP	155	LF	102.00	15,810.00
5	27" CIPP Lining (1700-16 to 1700-15 & 6295-01 to 1700-04)	Coated ACP	5,304	LF	97.00	514,488.00
6	27" Pre-Liner for CIPP Lining	Coated ACP	5,304	LF	7.00	37,128.00
7	27" CIPP Lining (1700-15 to 6295-01)	VCP	852	LF	97.00	82,644.00

SUBTOTAL - CIPP LINING REHABILITATION \$ 690,650.00**MANHOLE REHABILITATION & COATING - PHASE 2**

1	Rehabilitate & Coat Existing Manholes		160	VF	N/A	N/A
2	Rehabilitate & Coat Existing Base for MH Structural Insert (MH 1700-12)		1	EA	N/A	N/A
3	Coat New CIP MH Base for 60" Manhole Removal/Replacement (MH 1700-07)		1	EA	N/A	N/A
4	Coat New CIP MH Base for 84" Manhole Removal/Replacement (MH 1700-15, 6295-01, 1700-11, 1700-09, 1700-08)		5	EA	N/A	N/A
5	Specification Item E.3.i - Efforts for cosmetic finish work to provide irregularity free uniform finish, free from trowel marks, voids, depressions, ripples, waves, bubbles, bumps or cracking in the final coating layer using an approved repair method. To provide uniform profile for coating.		96	HR	N/A	N/A
6	1-inch additional underlayment application for extremely deteriorated manholes		44	VF	N/A	N/A

SUBTOTAL - MH REHABILITATION & COATINGS N/A****Please List Your Installation Days Required to Complete Your Own Scope of Work (Calendar Days):**CIPP Lining Fourteen (14)MH Coatings N/A****Please List any MH's That Require CIPP Inversion Access, Cone/Barrel Removals or Base Modifications Below:**Need legal and physical access provided to MH 1700-04 for use as a tail MH.

NOTE: An inversion MH is the manhole that a shot is installed from. A tail MH is the manhole that a shot terminates at.

C. Phase 3 Rehabilitation Section - Sabino Canyon Rd. to Craycroft Rd (MH 1700-04 to 5033-03)

Item Number & Description	Pipe Material	Quantity	Unit	Unit Price	Total
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CIPP LINING REHABILITATION - PHASE 3

1	Mobilization		1	LS	10,000.00	10,000.00
2	27" CIPP Lining (MH 1700-04 to MH 1714-12)	Coated ACP	1,857	LF	97.00	180,129.00
3	27" Pre-Liner for CIPP Lining (MH 1700-04 to MH 1714-12)	Coated ACP	1,857	LF	6.00	11,142.00
4	30" CIPP Lining (MH 1714-12 to MH 1714-08 and MH 1714-07 to MH 5033-03)	Unlined RCP	7,938	LF	96.00	762,048.00
5	30" CIPP Lining (MH 1714-08 to MH 1714-07)	VCP	883	LF	96.00	84,768.00

SUBTOTAL - CIPP LINING REHABILITATION \$ 1,048,087.00**MANHOLE REHABILITATION & COATING - PHASE 3**

1	Rehabilitate & Coat Existing Manholes		423	VF	N/A	N/A
2	Specification Item E.3.1 - Efforts for cosmetic finish work to provide irregularity free uniform finish, free from trowel marks, voids, depressions, ripples, waves, bubbles, bumps or cracking in the final coating layer using an approved repair method. To provide uniform profile for coating.		184	HR	N/A	N/A
3	1-inch additional underlayment application for extremely deteriorated manholes		106	VF	N/A	N/A

SUBTOTAL - MH REHABILITATION & COATINGS N/A****Please List Your Installation Days Required to Complete Your Own Scope of Work (Calendar Days):**CIPP Lining Fifteen (15)MH Coatings N/A****Please List any MH's That Require CIPP Inversion Access, Cone/Barrel Removals or Base Modifications Below:**

See phase 2 for access needed to MH 1700-04. Need legal & physical access provided to MH 8240-01 & 1714-04 for use as inversion MH's.

Need legal & physical access provided to MH 1714-08 for use as an over-the-hole (OTH) inversion MH.

Need legal & physical access provided to MH 1714-05A for use as a tail MH. Need cone/barrel removals for MH 1714-01.

NOTE: An inversion MH is the manhole that a shot is installed from. A tail MH is the manhole that a shot terminates at.

D. Phase 4 Rehabilitation Section - Craycroft Rd to Swan Rd (MH 5033-03 to 1712-01)

Item Number & Description	Pipe Material	Quantity	Unit	Unit Price	Total
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CIPP LINING REHABILITATION - PHASE 4

1	Mobilization		1	LS	10,000.00	10,000.00
2	30" CIPP Lining (MH 5033-03 to MH 1712-06)	Unlined RCP	2,681	LF	96.00	257,376.00
3	33" CIPP Lining (MH 1712-06 to MH 1712-01)	Unlined RCP	2,761	LF	114.00	314,754.00

SUBTOTAL - CIPP LINING REHABILITATION \$ 582,130.00**MANHOLE REHABILITATION & COATING - PHASE 4**

1	Rehabilitate & Coat Existing Manholes		141	VF	N/A	N/A
	Specification Item E.3.i - Efforts for cosmetic finish work to provide irregularity free uniform finish, free from trowel marks, voids, depressions, ripples, waves, bubbles, bumps or cracking in the final coating layer using an approved repair method. To provide uniform profile for coating.		80	HR	N/A	N/A
3	1-inch additional underlayment application for extremely deteriorated manholes		36	VF	N/A	N/A

SUBTOTAL - MH REHABILITATION & COATINGS N/A****Please List Your Installation Days Required to Complete Your Own Scope of Work (Calendar Days):**CIPP Lining Nine (9)MH Coatings N/A****Please List any MH's That Require CIPP Inversion Access, Cone/Barrel Removals or Base Modifications Below:**Need legal & physical access provided to MH 1712-07 for use as a tail MH.Need legal & physical access provided to MH 1712-06 for use as an over-the-hole (OTH) inversion MH.Need cone/barrel removals for MH 1712-06.**NOTE:** An inversion MH is the manhole that a shot is installed from. A tail MH is the manhole that a shot terminates at.

E Phase 5 Rehabilitation Section - Swan Rd to River and Alvernon Way (MH 1712-01 TO 1710-05)

Item Number & Description	Pipe Material	Quantity	Unit	Unit Price	Total
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CIPP LINING REHABILITATION - PHASE 5

1	Mobilization		1	LS	12,000.00	12,000.00
2	33" CIPP Lining (MH 1712-01 to MH 1710-05)	Unlined RCP	5,383	LF	114.00	613,662.00

SUBTOTAL - CIPP LINING REHABILITATION \$ 625,662.00

MANHOLE REHABILITATION & COATING - PHASE 5

1	Rehabilitate Existing Sewer Manholes		220	VF	N/A	N/A
2	Specification Item E.3.1 - Efforts for cosmetic finish work to provide irregularity free uniform finish, free from trowel marks, voids, depressions, ripples, waves, bubbles, bumps or cracking in the final coating layer using an approved repair method. To provide uniform profile for coating.		80	HR	N/A	N/A
3	1-inch additional underlayment application for extremely deteriorated manholes		55	VF	N/A	N/A

SUBTOTAL - MH REHABILITATION & COATINGS N/A

****Please List Your Installation Days Required to Complete Your Own Scope of Work (Calendar Days):**

CIPP Lining Eight (8)

CIPP Test Section Lab Test Result Turnaround Time Two (2)

MH Coatings N/A

****Please List any MH's That Require CIPP Inversion Access, Cone/Barrel Removals or Base Modifications Below:**

Need legal & physical access provided to MH 1710-10 for use as an over-the-hole (OTH) inversion MH.

Need cone/barrel removals for MH 1710-10 & MH 1710-06.

NOTE: An inversion MH is the manhole that a shot is installed from. A tail MH is the manhole that a shot terminates at.

F Phase 6 Rehabilitation Section - River and Alvernon Way to West of Campbell (MH 1710-05 TO 8809-01)

Item Number & Description	Pipe Material	Quantity	Unit	Unit Price	Total
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CIPP LINING REHABILITATION - PHASE 6

1	Mobilization		1	LS	10,000.00	10,000.00
2	33" CIPP Lining (MH 1710-05 to MH 1710-01)	Unlined RCP	2,397	LF	114.00	273,258.00
3	33" CIPP Lining (MH 1710-01 to MH 5117-05)	J-Lock RCP	2,715	LF	114.00	309,510.00
4	36" CIPP Lining (MH 5117-05 to MH 1708-13)	T-Lock RCP	9,686	LF	139.00	1,346,354.00

SUBTOTAL - CIPP LINING REHABILITATION **\$ 1,939,122.00**

MANHOLE REHABILITATION & COATING - PHASE 6

1	Rehabilitate Existing Sewer Manholes	653	VF	N/A	N/A
2	Coat New CIP MH Base for 84" Manhole Removal/Replacement (MH 1708-34A)	1	EA	N/A	N/A
3	Coat New CIP MH Base for 120" Manhole Removal/Replacement (MH 1708-36, 1708-34, 1708-25)	3	EA	N/A	N/A
4	Specification Item E.3.1 - Efforts for cosmetic finish work to provide irregularity free uniform finish, free from trowel marks, voids, depressions, ripples, waves, bubbles, bumps or cracking in the final coating layer using an approved repair method. To provide uniform profile for coating.	280	HR	N/A	N/A
5	1-inch additional underlayment application for extremely deteriorated manholes	164	VF	N/A	N/A

SUBTOTAL - MH REHABILITATION & COATINGS **N/A**

****Please List Your Installation Days Required to Complete Your Own Scope of Work (Calendar Days):**

CIPP Lining Twenty-five (25)

MH Coatings N/A

****Please List any MH's That Require CIPP Inversion Access, Cone/Barrel Removals or Base Modifications Below:**

Need cone/barrel removals for MH 1708-15.

NOTE: An inversion MH is the manhole that a shot is installed from. A tail MH is the manhole that a shot terminates at.

NORTH RILLITO INTERCEPTOR REHABILITATION BID RECAP

Phase 1 Rehabilitation Section TOTAL BASE BID (ITEM A) \$ 535,963.00 (for CIPP lining)

Phase 2 Rehabilitation Section TOTAL BASE BID (ITEM B) \$ 690,650.00 (for CIPP lining)

Phase 3 Rehabilitation Section TOTAL BASE BID (ITEM C) \$ 1,048,087.00 (for CIPP lining)

Phase 4 Rehabilitation Section TOTAL BASE BID (ITEM D) \$ 582,130.00 (for CIPP lining)

Phase 5 Rehabilitation Section TOTAL BASE BID (ITEM E) \$ 625,662.00 (for CIPP lining)

Phase 6 Rehabilitation Section TOTAL BASE BID (ITEM F) \$ 1,939,122.00 (for CIPP lining)

MH Coatings - 5 Year Warranty/Maintenance Bond COST N/A

PROJECT TOTAL **\$ 5,421,614.00 (for CIPP lining)**

G ADD ALTERNATES

Item Number & Description	Quantity	Unit	Unit Price	Total
1 Rehabilitate & Coat Existing Sabino Creek Siphon Inlet & Outlet Structure. Including new redwood diversion stop logs. (*B&F to provide new precast structure lids and openings)	1	LS	N/A	N/A
2 CIPP lining repair for removal of bumps, or wrinkles using an epoxy product in coated ACP Reaches	1	EA	15,000.00	15,000.00
3 HCS Reinstatement	1	EA	1,000.00	1,000.00

9 Items to Include with Bid

1. CIPP Shot Schedule
2. Crew Availability & Crew Size
3. Key Personnel
4. Current Workload
5. List of MH's that require modification for CIPP Lining Access
6. List of trenching requirements for CIPP construction water and supply pipe (if required)

10 Project Duration

Time is of the essence. Bidder agrees to complete their own scope of work in the allotted Calendar Days listed above on the bid schedule. Failure to meet this schedule due to non-performance will result in Liquidated Damages.

11 Total Installation Days - Phases 1 to 6

CIPP INSTALLATION CALENDAR DAYS Eighty-seven (87)
MH COATING INSTALLATION CALENDAR DAYS N/A

12 Bond

Total amount (or percentage) to be added to this Bid if Bidder is required to provide Performance and Payment Bond is N/A / 1.0 %. The subcontractor must list their bonding company and agent with a phone number and contact name.

Surety Company: Travelers Casualty and Surety Company of America

Agent/Firm: J.W. Terrill

Agent Name/Phone Number: Dana Dragoy 314-594-2655

13 2nd & 3rd Tier Subcontractors (Subs to Subcontractors)

The following Tiered-Subcontractors are proposed to perform work on this Project. This list is complete and no additional subcontractors shall be allowed on the project site without prior approval:

Company	Phone	Scope of Work
None		

14 Approved Suppliers/Vendors

The following Suppliers/Vendors and Products will be used to complete this Project. This list is complete and no changes shall be allowed prior to approval (CIPP bidder shall include proposed liner design and mill thickness, liner manufacturer and resin supplier below).

Approved Supplier/Vendor

Product/Materials Supplied

Applied Felts, Inc.

CIPP Tube

AOC, LLC

CIPP Resin

CIPP Bidder has included proposed liner and resin specification with Bid:

Yes X No _____

CIPP Bidder has included proposed liner mill thickness with Bid:

Yes X No _____

CIPP Bidder has include pre-liner material with Bid:

Yes X No _____

Manhole Rehab Contractor has included Performance History per the Technical Specifications

N/A Yes _____ No _____

15 Insurance

Bidders insurance coverage meets or exceeds the PCRWRD's contract requirements:

Yes X No _____

The subcontractor must list their insurance company and agent with a contact name and number.

Insurance Company: Amerisure Mutual Insurance Company

Agent/Firm: J.W. Terrill

Agent Name / Phone Number: Nancy Schwer 314-594-2779

16 Pollution Insurance

CIPP Bidder shall furnish a Contractor's Pollution Liability coverage, with limits of liability no less than \$2,000,000 / event and \$4,000,000 aggregate. Bidders' pollution liability insurance coverage meets or exceeds this requirement.

Yes X No _____

17 Proposal Documents

Project Drawings - PCRWRD Project No. 3NRI14 dated 2/05/2013

Technical Specifications - PCRWRD Project No. 3NRI14 dated 2/05/2013

CCTV Pre-Video

NRI As-Builts

ACP CIPP Lining Investigation Videos (Pre & Post Lining)

Manhole Investigation Report performed by Brown and Caldwell

Manhole Investigation Photos of MH Interior

Flow Management Plan provided by B&F Contracting Inc. (Phase 1, 2 & 5)

18 Liquidated Damages

Additional installation days for CIPP or MH Coating Work, outside of your Calendar Days listed above will result in liquidated damages to cover the costs of the Flow Management System. Liquidated Damages are calculated as follows:

CIPP Lining = \$11,192.00 per calendar day

MH Coatings = \$2,680.00 per calendar day

19 Acknowledgments

Addendum One (1) Dated 10/02/14

Addendum _____

Dated _____

Addendum Two(2) Dated 10/07/14

Addendum _____

Dated _____

Addendum Three (3) Dated 10/09/14

Addendum _____

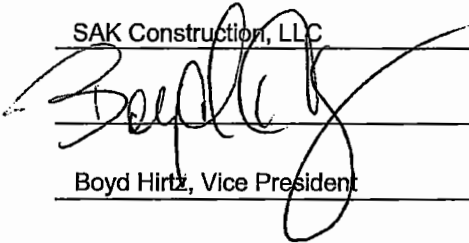
Dated _____

Bidder Acknowledgement:

Bidder acknowledges the above addenda and once submitted, this Bid may not be altered, amended or withdrawn for a period of (90) days without prior written consent of B&F Contracting, Inc.

20 Signature

Bidder herein agrees that if awarded the work on the basis of this Bid Proposal, he will enter into and execute a sub-contract agreement with B&F Contracting Inc.

Company / Bidder: SAK Construction, LLC
Signature: 
Title: Boyd Hirtz, Vice President
Date: 10/10/14

Arizona Contractors License No: 246314

J.W.TERRILL

August 15, 2012

RE: SAK Construction, LLC

Insurance, Benefits & Risk Management

Suite 200
825 Maryville Centre Drive
Chesterfield, MO 63017

314-594-2700

www.jwterrill.com

To Whom It May Concern:

SAK Construction, LLC is a valued Travelers Casualty and Surety Company of America surety customer. Travelers Casualty and Surety Company of America is one of the most financially sound insurance companies in the United States and enjoys a Best Rating of A+ with financial strength category of XIV, the highest rating awarded.

Due to SAK Construction, LLC's reputation, technical expertise, financial strength, quality equipment and experienced labor force, J.W. Terrill, Inc. is prepared to consider performance and payment bonds for single jobs in the \$100,000,000 range with an aggregate work program of \$300,000,000 with an available bonding capacity of \$100,000,000.

Any bonds are subject to acceptable review of the contract terms and conditions, bond forms, confirmation of financing, and any other underwriting considerations at the time of the request. It should be understood that any arrangement for bonds is strictly a matter between SAK Construction, LLC and Travelers Casualty and Surety Company of America. We assume no liability to third parties or to you if for any reason we do not execute said bonds.

Over the course of J.W. Terrill's relationship with SAK Construction, LLC, we have never had a complaint as respects any of their workmanship or a question as to their ability to perform on any project. Additionally, SAK Construction, LLC's pro-active approach to a safe worksite and a safe labor force enables owners to rest assured that a safe work environment will be provided.

Please feel free to contact me if you have any specific questions regarding SAK Construction, LLC or their surety bond program.

Sincerely,



Andrew P. Thome,
President

Bonding Agent

J.W. Terrill, Inc.
825 Maryville Centre Drive
Chesterfield, MO 63017
Contact: Salena Wood (314) 594-2700
(314) 594-2500- Facsimile

OWNER: Pima County, AZ, Regional Wastewater Reclamation Department (PCRWRD)
 CMAR: B&F Contracting, Inc.
 PROJECT: North Rillito Interceptor Rehabilitation Project, PN 3NR114



CIPP STRUCTURAL DESIGN CALCULATIONS

DESIGN PARAMETERS COMMON ACROSS ENTIRE PROJECT (for parameters that vary by line segment, see the table below)

CIPP Flexural Properties Utilized for Design

Short-term Flexural Modulus: 400,000 psi for 18" to 36" diameter. 350,000 psi for 15" diameter
 Long-term Flexural Modulus (retention 50%): 200,000 psi for 18" to 36" diameter. 175,000 psi for 15" diameter
 Flexural Strength: 4,500 psi

Other Design Parameters

Host Pipe Condition: Fully Deteriorated
 Factor of Safety: 2.0
 Ovality: 5.0%
 Soil Depth (above pipe crown): Based on max manhole depth per pipeline segment from as-built drawings - See Table
 Water Table (above pipe crown): For Phase 1 & 2, two feet above the crown - See Table.
 For Phase 3 - 6, no groundwater (for design purposes, assume groundwater at pipe invert) - See Table
 Unit Weight of Soil: 120 pcf
 Modulus of Soil Reaction: 1,000 psi
 Live Loading: AASHTO H20 highway loading

SHOT NO.	SHEET	PHASE	U/S MH	D/S MH	LOCATION	DIAM. (IN)	U/S DEPTH TO INVERT (VF)	D/S DEPTH TO INVERT (VF)	DEPTH FOR DESIGN TO CROWN (VF)	WTR TABLE FOR DESIGN ABOVE CROWN (VF)	DESIGN THICKNESS (MM)	INSTALL THICKNESS (MM)
1	NRI 12	1	8716-20	8716-19	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	10.3	10.6	9.4	2.0	5.83	7.5
1	NRI 12	1	8716-19	8716-18	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	10.6	12.4	11.2	2.0	6.21	7.5
2	NRI 12	1	8716-18	8716-17	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	12.4	12.8	11.8	2.0	6.29	7.5
2	NRI 12	1	8716-17	8716-16	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	12.8	13.6	12.4	2.0	6.46	7.5
3	NRI 12	1	8716-16	8716-15	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	13.6	12.3	12.4	2.0	6.46	7.5
3	NRI 12	1	8716-15	8716-14	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	12.3	12.3	11.1	2.0	6.19	7.5
4	NRI 12	1	8716-14	8716-13	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	12.3	11.8	11.1	2.0	6.19	7.5
4	NRI 12	1	8716-13	8729-01	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	11.8	11.8	10.6	2.0	6.09	7.5
4	NRI 12	1	8729-01	8716-12	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	11.8	11.7	10.6	2.0	6.09	7.5
5	NRI 12	1	8716-12	8716-11	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	11.7	12.0	10.8	2.0	6.13	7.5
5	NRI 12	1	8716-11	8716-10	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	15	12.0	11.8	10.8	2.0	6.13	7.5
6	NRI 12	1	8716-10	8716-09	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	16	11.8	11.4	10.3	2.0	6.91	7.5
6	NRI 11	1	8716-09	8716-08	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	16	11.4	11.0	9.9	2.0	6.82	7.5
6	NRI 11	1	8716-08	8716-07	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	16	11.0	11.2	9.7	2.0	6.77	7.5
7	NRI 11	1	8716-07	8716-06	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	16	11.2	12.0	10.5	2.0	6.82	7.5
7	NRI 11	1	8716-06	8716-05	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	16	12.0	10.9	10.5	2.0	6.82	7.5
7	NRI 11	1	8716-05	8716-04	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	16	10.9	11.4	9.9	2.0	6.82	7.5
8	NRI 11	1	8716-04	8716-03	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	16	11.1	11.2	9.7	2.0	6.77	7.5
9	NRI 11	1	8716-03	4466-IN	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4466-IN)	24	11.2	9.6	9.2	2.0	8.86	9.0
10	NRI 11	2	4466-OUT	1811-01A	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	24	10.7	11.2	9.2	2.0	8.86	9.0
11	NRI 11	2	1811-01A	1700-16	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	21	11.2	15.6	13.9	2.0	9.04	10.5
12	NRI 11	2	1700-16	1700-15	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	16.1	14.2	13.9	2.0	11.62	12.0
12	NRI 11	2	1700-15	6295-04	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	14.2	14.2	12.0	2.0	10.88	12.0
12	NRI 11	2	6295-04	6295-03	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	14.2	12.0	12.0	2.0	10.88	12.0
12	NRI 11	2	6295-03	6295-02	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	12.0	8.8	9.8	2.0	10.19	12.0
12	NRI 11	2	6295-02	6295-01	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	8.8	12.9	10.7	2.0	10.51	12.0
12	NRI 11	2	6295-01	1700-13	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	12.9	12.0	10.7	2.0	10.51	12.0
13	NRI 11	2	1700-13	1700-12	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	12.0	11.5	9.8	2.0	10.19	10.5
13	NRI 11 & NRI 10	2	1700-12	1700-11	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	11.5	11.1	9.3	2.0	10.00	10.5
14	NRI 10	2	1700-11	1700-10	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	11.1	13.4	11.2	2.0	10.89	12.0
15	NRI 10	2	1700-10	1700-09	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	13.4	11.4	11.2	2.0	10.89	12.0
16	NRI 10	2	1700-09	1700-08	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	11.4	11.3	9.2	2.0	9.97	12.0
16	NRI 10	2	1700-08	1700-07A	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	11.3	9.8	9.1	2.0	9.83	10.5
16	NRI 10	2	1700-07A	1700-07	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	9.8	6.7	7.6	2.0	9.65	10.5
17	NRI 10	2	1700-07	1700-06A	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	6.7	12.3	10.1	2.0	10.30	12.0
17	NRI 10	2	1700-06A	1700-06	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	12.3	13.6	11.4	2.0	10.76	12.0
17	NRI 10	2	1700-06	1700-05	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	13.6	15.7	13.5	2.0	11.49	12.0
17	NRI 10	2	1700-05	1700-04	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4466-OUT to 1700-04)	27	15.7	16.4	14.2	2.0	11.72	12.0
18	NRI 10	3	1700-04	8240-01	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	27	16.4	17.3	15.1	-2.3	11.84	12.0
19	NRI 10	3	8240-01	1700-02	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	27	17.3	18.1	15.9	-2.3	11.90	13.5
19	NRI 10	3	1700-02	1700-01	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	27	18.1	19.8	17.6	-2.3	12.42	13.5
19	NRI 10	3	1700-01	1714-12	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	27	19.8	22.8	20.6	-2.3	13.27	13.5
20	NRI 10	3	1714-12	8705-01A	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	23.1	21.4	20.6	-2.5	14.74	15.0
20	NRI 9	3	8705-01A	1714-11	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	21.4	20.4	18.9	-2.5	14.22	15.0
20	NRI 9	3	1714-11	4623-06	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	20.4	20.0	17.9	-2.5	13.90	15.0
20	NRI 9	3	4623-06	1714-10	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	20.0	19.2	17.5	-2.5	13.76	15.0
21	NRI 9	3	1714-10	4623-12	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	19.2	14.8	12.7	-2.5	12.02	13.5
21	NRI 9	3	4623-12	1714-09	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	14.8	13.9	12.3	-2.5	11.86	12.0
21	NRI 9	3	1714-09	1714-08	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	13.9	12.4	11.4	-2.5	11.49	12.0
22	NRI 9	3	1714-08	8282-01	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	12.4	13.3	10.8	-2.5	11.23	13.5
22	NRI 9	3	8282-01	1714-07	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	13.3	15.9	13.4	-2.5	12.29	13.5
22	NRI 9	3	1714-07	1714-06	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	15.9	11.7	13.4	-2.5	12.29	13.5

OWNER: Pima County, AZ, Regional Wastewater Reclamation Department (PCRWRD)
 CMAR: B&F Contracting, Inc.
 PROJECT: North Rillito Interceptor Rehabilitation Project, PN 3NR14



CIPP STRUCTURAL DESIGN CALCULATIONS

DESIGN PARAMETERS COMMON ACROSS ENTIRE PROJECT (for parameters that vary by line segment, see the table below)

CIPP Flexural Properties Utilized for Design

Short-term Flexural Modulus:	400,000 psi for 18" to 36" diameter. 350,000 psi for 15" diameter
Long-term Flexural Modulus (retention 50%):	200,000 psi for 18" to 36" diameter. 175,000 psi for 15" diameter
Flexural Strength:	4,500 psi

Other Design Parameters

Host Pipe Condition:	Fully Deteriorated
Factor of Safety:	2.0
Ovality:	5.0%
Soil Depth (above pipe crown):	Based on max manhole depth per pipeline segment from as-built drawings - See Table
Water Table (above pipe crown):	For Phase 1 & 2, two feet above the crown - See Table. For Phase 3 - 6, no groundwater (for design purposes, assume groundwater at pipe invert) - See Table
Unit Weight of Soil:	120 pcf
Modulus of Soil Reaction:	1,000 psi
Live Loading:	AASHTO H20 highway loading

SHOT NO.	SHEET	PHASE	U/S MH	D/S MH	LOCATION	DIAM. (IN)	U/S DEPTH TO INVERT (VF)	D/S DEPTH TO INVERT (VF)	DEPTH FOR DESIGN TO CROWN (VF)	WTR TABLE FOR DESIGN ABOVE CROWN (VF)	DESIGN THICKNESS (MM)	INSTALL THICKNESS (MM)
22	NRI 9 & 8	3	1714-06	1714-05A	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	11.7	8.9	9.2	-2.5	10.73	13.5
23	NRI 8	3	1714-05A	1714-05	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	8.9	11.8	9.1	-2.5	10.73	12.0
23	NRI 8	3	1714-05	1714-04	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	11.8	8.7	9.1	-2.5	10.73	12.0
24	NRI 8	3	1714-04	1714-03	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	8.7	12.5	10.0	-2.5	10.89	13.5
24	NRI 8	3	1714-03	1714-02	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	12.5	13.1	10.6	-2.5	11.15	13.5
24	NRI 8	3	1714-02	1714-01A	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	13.1	15.2	12.7	-2.5	12.02	13.5
24	NRI 8	3	1714-01A	1714-01	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	15.2	20.7	18.2	-2.5	13.99	15.0
25	NRI 8	3	1714-01	8964-01	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	20.7	21.2	18.7	-2.5	14.15	15.0
25	NRI 8	3	8964-01	5033-03	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	30	21.2	22.3	19.8	-2.5	14.50	15.0
25	NRI 8	4	5033-03	1801-01	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	30	22.3	23.8	21.3	-2.5	14.95	15.0
25	NRI 8	4	1801-01	1712-09	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	30	23.8	14.8	21.3	-2.5	14.95	15.0
25	NRI 8	4	1712-09	1712-08	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	30	14.8	8.0	12.3	-2.5	11.86	15.0
25	NRI 8	4	1712-08	1712-07	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	30	8.0	10.5	8.0	-2.5	10.73	15.0
26	NRI 7	4	1712-07	1712-06	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	30	10.5	16.3	13.8	-2.5	12.45	13.5
27	NRI 7	4	1712-06	1712-05	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	33	16.3	9.1	13.6	-2.8	13.61	15.0
27	NRI 7	4	1712-05	1712-04	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	33	9.1	8.4	6.7	-2.8	11.80	13.5
27	NRI 7	4	1712-04	1712-03	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	33	8.4	11.9	9.2	-2.8	11.80	13.5
28	NRI 7	4	1712-03	1712-02	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	33	11.9	12.7	10.0	-2.8	11.98	12.0
28	NRI 7	4	1712-02	1712-01	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	33	12.7	12.6	10.0	-2.8	11.98	12.0
29	NRI 7	5	1712-01	1710-13	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	12.6	12.6	10.2	-2.8	12.07	13.5
29	NRI 7	5	1710-13	1710-12	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	12.6	22.7	20.0	-2.8	16.02	16.5
29	NRI 7	5	1710-12	1710-11	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	22.7	20.8	20.0	-2.8	16.02	16.5
29	NRI 7	5	1710-11	8980-01	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	20.8	22.5	19.8	-2.8	15.95	16.5
29	NRI 6	5	8980-01	1710-10	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	22.5	18.7	19.8	-2.8	15.95	16.5
30	NRI 6	5	1710-10	1710-09	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	18.7	21.9	19.2	-2.8	15.74	18.0
30	NRI 6	5	1710-09	1710-08	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	21.9	24.7	22.0	-2.8	16.66	18.0
30	NRI 6	5	1710-08	1710-07	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	24.7	24.4	22.0	-2.8	16.66	18.0
30	NRI 6	5	1710-07	1710-06	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	24.4	24.7	22.0	-2.8	16.66	18.0
31	NRI 6	5	1710-06	1710-05	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	33	24.7	25.0	22.3	-2.8	16.76	18.0
32	NRI 6	6	1710-05	1710-04	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	25.0	21.6	22.3	-2.8	16.76	18.0
32	NRI 6	6	1710-04	1710-03	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	21.6	19.4	18.9	-2.8	15.64	16.5
33	NRI 6	6	1710-03	1710-02	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	19.4	11.9	16.7	-2.8	14.84	15.0
33	NRI 5	6	1710-02	1710-01	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	11.9	10.4	9.2	-2.8	11.80	13.5
33	NRI 5	6	1710-01	1708-36	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	10.4	10.7	8.0	-2.8	11.80	13.5
34	NRI 5	6	1708-36	1708-35	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	10.7	12.9	10.2	-2.8	12.07	13.5
34	NRI 5	6	1708-35	1708-34A	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	12.9	15.2	12.5	-2.8	13.13	13.5
34	NRI 5	6	1708-34A	1708-34	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	15.2	15.1	12.5	-2.8	13.13	13.5
35	NRI 5	6	1708-34	1708-33	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	15.1	12.8	12.4	-2.8	13.09	13.5
35	NRI 5	6	1708-33	5117-08	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	12.8	11.1	10.1	-2.8	12.03	13.5
35	NRI 5	6	5117-08	5117-05	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	33	11.1	11.4	8.7	-2.8	11.80	13.5
36	NRI 5	6	5117-05	1708-30	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	11.4	15.1	12.1	-3.0	14.13	16.5
36	NRI 5	6	1708-30	1708-29	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	15.1	17.6	14.6	-3.0	15.30	16.5
36	NRI 5	6	1708-29	1708-28A	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.6	15.3	14.6	-3.0	15.30	16.5
36	NRI 5	6	1708-28A	1708-28	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	15.3	17.0	14.0	-3.0	15.03	16.5
36	NRI 5	6	1708-28	1708-27	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.0	23.0	20.0	-3.0	17.47	18.0
37	NRI 5	6	1708-27	1708-26	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	23.0	30.0	27.0	-3.0	19.90	21.0
37	NRI 5	6	1708-26	1708-25	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	30.0	33.0	30.0	-3.0	20.99	21.0
38	NRI 5	6	1708-25	5293-02	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	33.0	27.1	30.0	-3.0	20.69	21.0
38	NRI 5	6	5293-02	5293-01	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	27.1	25.7	24.1	-3.0	18.88	21.0
39	NRI 5	6	5293-01	1708-23	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	25.7	24.8	22.7	-3.0	18.42	19.5
39	NRI 5	6	1708-23	1708-22	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	24.8	23.8	21.8	-3.0	18.11	19.5
39	NRI 4	6	1708-22		Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	23.8	19.1	20.8	-3.0	17.76	19.5

OWNER: Pima County, AZ, Regional Wastewater Reclamation Department (PCRWRD)
 CMAR: B&F Contracting, Inc.
 PROJECT: North Rillito Interceptor Rehabilitation Project, PN 3NR14



CIPP STRUCTURAL DESIGN CALCULATIONS

DESIGN PARAMETERS COMMON ACROSS ENTIRE PROJECT (for parameters that vary by line segment, see the table below)

CIPP Flexural Properties Utilized for Design

Short-term Flexural Modulus: 400,000 psi for 18" to 36" diameter. 350,000 psi for 15" diameter
 Long-term Flexural Modulus (retention 50%): 200,000 psi for 18" to 36" diameter. 175,000 psi for 15" diameter
 Flexural Strength: 4,500 psi

Other Design Parameters

Host Pipe Condition: Fully Deteriorated
 Factor of Safety: 2.0
 Ovality: 5.0%
 Soil Depth (above pipe crown): Based on max manhole depth per pipeline segment from as-built drawings - See Table
 Water Table (above pipe crown): For Phase 1 & 2, two feet above the crown - See Table.
 For Phase 3 - 6, no groundwater (for design purposes, assume groundwater at pipe invert) - See Table
 Unit Weight of Soil: 120 pcf
 Modulus of Soil Reaction: 1,000 psi
 Live Loading: AASHTO H20 highway loading

SHOT NO.	SHEET	PHASE	U/S MH	D/S MH	LOCATION	DIAM. (IN)	U/S DEPTH TO INVERT (VF)	D/S DEPTH TO INVERT (VF)	DEPTH FOR DESIGN TO CROWN (VF)	WTR TABLE FOR DESIGN ABOVE CROWN (VF)	DESIGN THICKNESS (MM)	INSTALL THICKNESS (MM)
40	NRI 4	6	1708-22	1708-21	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	19.1	16.9	16.1	-3.0	15.95	16.5
40	NRI 4	6	1708-21	1708-20	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	16.9	17.0	14.0	-3.0	15.03	16.5
40	NRI 4	6	1708-20	3963-01	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.0	17.4	14.4	-3.0	15.21	16.5
40	NRI 4	6	3963-01	1716-01	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.4	17.2	14.4	-3.0	15.21	16.5
40	NRI 4	6	1716-01	1708-19A	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.2	17.1	14.2	-3.0	15.12	16.5
40	NRI 4	6	1708-19A	1708-19	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.1	15.7	14.1	-3.0	15.07	16.5
40	NRI 4	6	1708-19	1708-18A	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	15.7	15.7	12.7	-3.0	14.42	16.5
40	NRI 4	6	1708-18A	1708-18	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	15.7	16.3	13.3	-3.0	14.70	16.5
40	NRI 4	6	1708-18	8804-01	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	16.3	17.1	14.1	-3.0	15.07	16.5
41	NRI 4	6	8804-01	1708-17	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.1	15.7	14.1	-3.0	15.07	16.5
41	NRI 4	6	1708-17	1708-16	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	15.7	20.2	17.2	-3.0	16.40	16.5
41	NRI 4	6	1708-16	1708-15	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	20.2	19.5	17.2	-3.0	16.40	16.5
42	NRI 4	6	1708-15	1708-14	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	19.5	18.5	16.6	-3.0	16.15	16.5
42	NRI 4	6	1708-14	1708-13A	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	18.5	17.3	15.6	-3.0	15.82	16.5
42	NRI 4	6	1708-13A	8809-01	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.3	17.2	14.3	-3.0	15.16	16.5
42	NRI 4	6	8809-01	1708-13	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	36	17.2	16.5	14.2	-3.0	15.12	16.5

All CIPP thickness design calculations performed in accordance with Appendix X1 of ASTM F1216.

OWNER: Pima County, AZ, Regional Wastewater Reclamation Department (PCRWRD)

CMAR: B&F Contracting, Inc.

PROJECT: North Rillito Interceptor Rehabilitation Project, PN 3NRH4

CIPP LINING SHOT SCHEDULE



SAK™

Pipeline Infrastructure. Solved.™

PHASE	SHEET	SHOT NUMBER	INSTALL DIRECTION U/S OR D/S	U/S MH	D/S MH	U/S DEPTH	D/S DEPTH	LOCATION	WTR OR STM CURE (W/S)	PIPE TYPE	INSTALL THICKNESS	DIAM.	LINE LENGTH	SHOT LENGTH
1	NRI 12	1	D/S	8716-20	8716-19	10.3	10.3	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	507	
1	NRI 12	1	D/S	8716-19	8716-18	10.3	10.3	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	518	1,025
1	NRI 12	2	D/S	8716-18	8716-17	12.4	12.3	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	518	
1	NRI 12	2	D/S	8716-17	8716-16	12.3	12.3	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	518	1,036
1	NRI 12	3	D/S	8716-16	8716-15	12.3	12.3	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	518	
1	NRI 12	3	D/S	8716-15	8716-14	12.3	12.3	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	501	1,019
1	NRI 12	4	D/S	8716-14	8716-13	11.8	11.8	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	501	
1	NRI 12	4	D/S	8716-13	8716-12	11.8	11.7	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	346	1,002
1	NRI 12	5	D/S	8716-12	8716-11	11.7	12.0	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	501	
1	NRI 12	5	D/S	8716-11	8716-10	12.0	11.8	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	15	504	1,005
1	NRI 12	6	D/S	8716-10	8716-09	11.8	11.4	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	18	573	
1	NRI 11	6	D/S	8716-09	8716-08	11.4	11.0	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	18	466	
1	NRI 11	6	D/S	8716-08	8716-07	11.0	11.2	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	18	623	1,772
1	NRI 11	7	D/S	8716-07	8716-06	11.2	12.0	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	18	195	
1	NRI 11	7	D/S	8716-06	8716-05	12.0	10.9	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	18	284	
1	NRI 11	7	D/S	8716-05	8716-04	10.9	11.4	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	18	466	945
1	NRI 11	8	D/S	8716-03	8716-02	11.1	11.2	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	Coated ACP	7.5	18	269	269
1	NRI 11	9	D/S	8716-02	4468-IN	11.2	9.8	Phase 1 - Woodland Road to Sabino Creek Siphon (MH 8716-20 to 4468-IN)	W	VCP	9.0	24	416	416
2	NRI 11	10	U/S	4468-OUT	1811-01A	10.7	11.2	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	VCP	9.0	24	155	155
2	NRI 11	11	U/S	1811-01A	1700-16	11.2	15.6	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	10.5	21	278	278
2	NRI 11	12	D/S	1700-16	1700-15	16.1	14.2	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	433	
2	NRI 11	12	D/S	1700-15	1700-04	14.2	14.2	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	VCP	12.0	27	314	
2	NRI 11	12	D/S	6295-04	6295-03	14.2	12.0	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	VCP	12.0	27	345	
2	NRI 11	12	D/S	6295-03	6295-02	12.0	8.8	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	VCP	12.0	27	146	
2	NRI 11	12	D/S	6295-02	6295-01	8.8	12.8	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	VCP	12.0	27	254	1,508
2	NRI 11	12	D/S	6295-01	1700-13	12.9	12.0	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	685	
2	NRI 11	13	U/S	1700-13	1700-12	12.0	11.5	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	10.5	27	715	1,400
2	NRI 11 & NRI 10	13	U/S	1700-12	1700-11	11.5	11.1	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	10.5	27	291	291
2	NRI 10	14	U/S	1700-11	1700-10	11.1	13.4	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	425	
2	NRI 10	15	D/S	1700-10	1700-09	13.4	11.4	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	195	620
2	NRI 10	15	D/S	1700-09	1700-08	11.4	11.3	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	751	
2	NRI 10	16	D/S	1700-08	1700-07A	11.3	9.8	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	10.5	27	302	1,053
2	NRI 10	16	D/S	1700-07A	1700-07	9.8	6.7	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	10.5	27	191	
2	NRI 10	17	D/S	1700-07	1700-06A	6.7	12.3	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	350	
2	NRI 10	17	D/S	1700-06A	1700-06	12.3	13.6	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	318	1,238
2	NRI 10	17	D/S	1700-06	1700-05	13.6	15.7	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	794	794
2	NRI 10	17	D/S	1700-05	1700-04	15.7	16.4	Phase 2 - Sabino Creek Siphon to Sabino Canyon Road (MH 4468-OUT to 1700-04)	W	Coated ACP	12.0	27	175	
3	NRI 10	18	U/S	1700-04	8240-01	16.4	17.3	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Coated ACP	12.0	27	418	
3	NRI 10	19	D/S	8240-01	1700-02	17.3	16.1	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Coated ACP	13.5	27	467	1,060
3	NRI 10	19	D/S	1700-02	1700-01	16.1	19.8	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Coated ACP	13.5	27	470	
3	NRI 10	19	D/S	1700-01	1714-12	19.8	22.8	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Coated ACP	13.5	27	385	
3	NRI 10	20	D/S	1714-12	8705-01A	23.1	21.4	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	15.0	30	310	1,815
3	NRI 9	20	D/S	8705-01A	1714-11	21.4	20.4	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	15.0	30	445	
3	NRI 9	20	D/S	1714-11	4623-06	20.4	20.0	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	15.0	30	555	
3	NRI 9	20	D/S	4623-06	1714-10	20.0	15.2	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	15.0	30	747	1,747
3	NRI 9	21	U/S	1714-10	4623-12	15.2	14.8	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	13.5	30	57	
3	NRI 9	21	U/S	4623-12	1714-09	14.8	13.9	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	12.0	30	826	
3	NRI 9	21	U/S	1714-09	1714-08	13.9	12.4	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	12.0	30	963	
3	NRI 9	22	D/S	1714-08	8282-01	12.4	13.3	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	VCP	13.5	30	840	2,708
3	NRI 9	22	D/S	8282-01	1714-07	13.3	15.9	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	VCP	13.5	30	162	
3	NRI 9	22	D/S	1714-07	1714-06	15.9	11.7	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	13.5	30	740	902
3	NRI 9 & 8	22	D/S	1714-06	1714-05A	11.7	8.9	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	13.5	30	208	
3	NRI 8	23	U/S	1714-05A	1714-05	8.9	11.6	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	12.0	30	604	
3	NRI 8	23	U/S	1714-05	1714-04	11.6	8.7	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	12.0	30	206	1,772
3	NRI 8	24	U/S	1714-04	1714-03	8.7	12.5	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	13.5	30	50	
3	NRI 8	24	U/S	1714-03	1714-02	12.5	13.1	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	13.5	30	63	
3	NRI 8	24	U/S	1714-02	1714-01A	13.1	15.2	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	15.0	30	83	
3	NRI 8	24	U/S	1714-01A	1714-01	15.2	20.7	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	15.0	30	202	
3	NRI 8	25	D/S	1714-01	8964-01	20.7	21.2	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	15.0	30	238	
3	NRI 8	25	D/S	8964-01	5033-03	21.2	22.3	Phase 3 - Sabino Canyon Road to Craycroft Road (MH 1700-04 to 5033-03)	W	Unlined RCP	15.0	30	835	2,077
4	NRI 8	25	D/S	5033-03	1801-01	22.3	23.8	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	15.0	30	882	682
4	NRI 8	25	D/S	1801-01	1712-09	23.8	14.8	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	15.0	30	665	
4	NRI 8	25	D/S	1712-09	1712-08	14.8	8.0	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	15.0	30	582	
4	NRI 7	26	D/S	1712-08	1712-07	8.0	10.5	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	13.5	30	565	
4	NRI 7	26	D/S	1712-07	1712-06	10.5	16.3	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	15.0	33	582	
4	NRI 7	27	D/S	1712-06	1712-05	16.3	9.1	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	13.5	33	464	1,711
4	NRI 7	27	D/S	1712-05	1712-04	9.1	9.4	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	12.0	33	466	1,051
4	NRI 7	28	D/S	1712-04	1712-03	9.4	11.9	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	15.0	33	536	
4	NRI 7	28	D/S	1712-03	1712-02	11.9	12.7	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	16.5	33	741	
4	NRI 7	29	U/S	1712-02	1712-01	12.7	12.6	Phase 4 - Craycroft Road to Swan Rd (MH 5033-03 to 1712-01)	W	Unlined RCP	16.5	33	457	
5	NRI 7	29	U/S	1712-01	1710-13	12.6	12.6	Phase 5 - Swan Rd to River and Avenon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	16.5	33	251	
5	NRI 7	29	U/S	1710-13	1710-12	12.6	22.7	Phase 5 - Swan Rd to River and Avenon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	16.5	33		
5	NRI 7	29	U/S	1710-12	1710-11	22.7	20.8	Phase 5 - Swan Rd to River and Avenon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	16.5	33		
5	NRI 7	29	U/S	1710-11	8980-01	20.8	22.5	Phase 5 - Swan Rd to River and Avenon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	16.5	33		

OWNER: Pima County, AZ, Regional Wastewater Reclamation Department (PCRWRD)

CMAR: B&F Contracting, Inc.

PROJECT: North Rillito Interceptor Rehabilitation Project, PN 3NR114

CIPP LINING SHOT SCHEDULE



SAKTM

Pipeline Infrastructure. Solved.TM

PHASE	SHEET	SHOT NUMBER	INSTALL DIRECTION U/S OR D/S	U/S MH	D/S MH	U/S DEPTH	D/S DEPTH	LOCATION	WTR OR STM CURE (W/S)	PIPE TYPE	INSTALL THICKNESS	DIAM.	LINE LENGTH	SHOT LENGTH
5	NR16	29	U/S	8980-01	1710-10	22.5	16.7	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	18.5	33	424	2,409
5	NR16	30	D/S	1710-10	1710-09	16.7	21.9	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	18.5	33	709	
5	NR16	30	D/S	1710-09	1710-08	21.9	24.7	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	18.5	33	551	
5	NR16	30	D/S	1710-08	1710-07	24.7	24.4	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	18.5	33	359	
5	NR16	30	D/S	1710-07	1710-06	24.4	24.7	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	18.5	33	819	2,438
5	NR16	31	D/S	1710-06	1710-05	24.7	25.0	Phase 5 - Swan Rd to River and Alvernon Way (MH 1712-01 to 1710-05)	W	Unlined RCP	18.5	33	550	550
6	NR16	32	D/S	1710-05	1710-04	25.0	21.6	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	Unlined RCP	18.5	33	494	
6	NR16	32	D/S	1710-04	1710-03	21.6	19.4	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	Unlined RCP	18.5	33	683	1,177
6	NR16	33	D/S	1710-03	1710-02	19.4	11.9	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	Unlined RCP	18.5	33	735	
6	NR16	33	D/S	1710-02	1710-01	11.9	10.4	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	Unlined RCP	18.5	33	484	
6	NR16	33	D/S	1710-01	1708-36	10.4	10.7	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	33	134	1,356
6	NR16	34	U/S	1708-36	1708-35	10.7	12.9	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	33	637	
6	NR16	34	U/S	1708-35	1708-34A	12.9	15.2	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	33	616	
6	NR16	34	U/S	1708-34A	1708-34	15.2	15.1	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	33	56	1,311
6	NR16	35	D/S	1708-34	1708-33	15.1	12.8	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	33	612	
6	NR16	35	D/S	1708-33	5117-06	12.8	11.1	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	33	628	
6	NR16	35	D/S	5117-06	5117-05	11.1	11.4	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	33	18	1,258
6	NR16	36	D/S	5117-05	1708-30	11.4	15.1	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	432	
6	NR16	36	D/S	1708-30	1708-29	15.1	17.6	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	120	
6	NR16	36	D/S	1708-29	1708-28A	17.6	15.3	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	512	
6	NR16	36	D/S	1708-28A	1708-28	15.3	17.0	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	757	
6	NR16	36	D/S	1708-28	1708-27	17.0	23.0	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	370	2,191
6	NR16	37	U/S	1708-27	1708-26	23.0	30.0	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	21.0	36	587	
6	NR16	37	U/S	1708-26	1708-25	30.0	33.0	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	21.0	36	691	1,278
6	NR16	38	D/S	1708-25	1708-24	33.0	27.1	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	21.0	36	307	
6	NR16	38	D/S	1708-24	5293-02	27.1	25.7	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	21.0	36	89	396
6	NR16	39	U/S	5293-02	5293-01	25.7	24.8	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	19.5	36	119	
6	NR16	39	U/S	5293-01	1708-23	24.8	23.8	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	19.5	36	125	
6	NR16	39	U/S	1708-23	1708-22	23.8	19.1	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	19.5	36	519	763
6	NR14	40	D/S	1708-22	1708-21	19.1	16.9	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	392	
6	NR14	40	D/S	1708-21	1708-20	16.9	17.0	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	313	
6	NR14	40	D/S	1708-20	3963-01	17.0	17.4	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	287	
6	NR14	40	D/S	3963-01	1716-01	17.4	17.2	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	165	
6	NR14	40	D/S	1716-01	1708-19A	17.2	17.1	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	40	
6	NR14	40	D/S	1708-19A	1708-19	17.1	15.7	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	534	
6	NR14	40	D/S	1708-19	1708-18A	15.7	15.7	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	392	
6	NR14	40	D/S	1708-18A	1708-18	15.7	16.3	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	188	
6	NR14	40	D/S	1708-18	8904-01	16.3	17.1	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	20	2,334
6	NR14	41	U/S	8904-01	1708-17	17.1	15.7	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	666	
6	NR14	41	U/S	1708-17	1708-16	15.7	20.2	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	488	
6	NR14	41	U/S	1708-16	1708-15	20.2	19.6	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	291	1,447
6	NR14	42	D/S	1708-15	1708-14	19.6	18.8	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	104	
6	NR14	42	D/S	1708-14	1708-13A	18.8	17.3	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	391	
6	NR14	42	D/S	1708-13A	8909-01	17.3	17.2	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	620	
6	NR14	42	D/S	8909-01	1708-13	17.2	16.5	Phase 6 - River and Alvernon Way to West of Campbell (MH 1710-05 to 1708-13)	W	T-Lock RCP	18.5	36	155	1,270

Data taken from drawings for PN 3NR114 and Pima County as-built drawings.

U/S = upstream, D/S = downstream

51,527 51,527

Product Information

Vipel Polyester Resin for Underground Sewer Pipe Liners

TYPICAL FILLED LIQUID RESIN PROPERTIES* (1) See back page

	Nominal
Viscosity @ 77°F/25°C, RVF Brookfield Spindle #4 @ 20 RPM, cps.	5,800
Thix Index 2/20	2.5+
Color	Opaque
Specific Gravity @ 77°F/25°C	1.29
Styrene, %	30
Gel Time @ 140°F with (1.0% Di-(4-tert-butyl-cyclohexyl) peroxydicarbonate and 0.5% Trigonox [®] C), minutes	12
Pot Life @ 77°F/25°C (1% Di-(4-tert-butyl-cyclohexyl) peroxydicarbonate and + 0.5% Trigonox [®] C), hours	40

Trigonox is a trademark of Akzo Nobel Chemicals

TYPICAL FILLED CAST MECHANICAL PROPERTIES* (2) See back page

		Test Method
Tensile Strength, psi/MPa	6,770/47	ASTM D 638
Tensile Modulus, psi/GPa	800,000/5.5	ASTM D 638
Tensile Elongation, %	1.6	ASTM D 638
Flexural Strength, psi/MPa	11,020/76	ASTM D 790
Flexural Modulus, psi/GPa	740,000/5.1	ASTM D 790
Heat Distortion Temperature, °F/°C @ 264 psi	259/126	ASTM D 648
Barcol Hardness	42	ASTM D 2583

*Typical properties are not to be construed as specifications.



DESCRIPTION

The Vipel L758-LTI is a high molecular weight unsaturated polyester resin. The Vipel L758-LTI provides the corrosion resistance, durability and toughness that is required for cured in place pipe applications.

BENEFITS

- Excellent catalyzed pot life
- Superior mechanical properties
- High molecular weight

Vipel® L758-LTI Polyester Resin

PERFORMANCE GUIDELINES

A. Keep full strength catalyst levels between 1.0% - 3.0% of the total resin weight.

B. Maintaining shop temperatures between 65°F/ 18°C and 90°F/32°C and humidity between 40% and 90% will help the fabricator make a high quality part. Consistent shop conditions contribute to consistent gel times.

STORAGE STABILITY

Resins are stable for three months from date of production when stored in the original containers away from sunlight at no more than 77°F/25°C. After extended storage, some drift may occur in gel time.

During the hot summer months, no more than two months stability at 86°F/30°C should be anticipated.

SAFETY

See appropriate Material Safety Data Sheet for guidelines.

ISO 9001:2008 CERTIFIED

The Quality Management Systems at every AOC manufacturing facility have been certified as meeting ISO 9001:2008 standards. This certification recognizes that each AOC facility has an internationally accepted model in place for managing and assuring quality. We follow the practices set forth in this model to add value to the resins we make for our customers.

FOOTNOTES

(1)

The pot life times shown are typical but may be affected by catalyst, promoter and inhibitor concentrations in resin, and environmental temperature. Variations in gelling characteristics can be expected between different lots of catalysts and at extremely high humidities. Pigment and fillers can retard or accelerate gelation. It is recommended that the fabricator check the gelling characteristics of a small quantity of resin under actual operating conditions prior to use.

(2)

Based on tests on Vipel L758-LTI pipe at 77°F/25°C and 50% relative humidity. Castings were prepared using 1.0% Perkadox 16 and 0.5 Trigonox C.



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The information contained in this data sheet is based on laboratory data and field experience. We believe this information to be reliable, but do not guarantee its applicability to the user's process or assume any liability for occurrences arising out of its use. The user, by accepting the products described herein, agrees to be responsible for thoroughly testing each such product before committing to production.

Our recommendations should not be taken as inducements to infringe any patent or violate any law, safety code or insurance regulation.

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TECHNICAL INFORMATION

Product: Eversion Liner for Hot Water/Steam Cure Installation **(PROCESS QUALITY CONTROL)**

1. Raw Materials

Each supplier is assessed against Quality Assurance criteria. If the supplier meets the criteria set out, then they may be included in our "Approved Supplier List". Periodic reviews take place of all of our approved suppliers to ensure that they continue to meet our criteria.

Inspection and test of raw materials, when received also enables us to assess the supplier as well as each batch of delivered raw material. Details are shown in Table 1.1.

Table 1.1

<u>Raw Material</u>	<u>Characteristic Tested</u>
Polyester fiber (Several specifications)	Staple length Crimp level Denier Shade Supplier Certification
Polyurethane granules (Several specifications)	Granularity Blocking Yellowness Supplier Certification
Tetrahydrofuran	Supplier Certification
Polyurethane film, sealing tape	Gauge Density Strength of weld - Heat Strength of weld - Chemical Opacity

2. Production of Felt (Nonwoven)

The sole raw material used in the production of felt is polyester staple fiber. The most suitable fiber specification for the customer's particular end-use is selected (on the basis of resin type, impregnation equipment, installation conditions and cure regime).

The process utilizes state of the art equipment and technology to ensure that the nonwoven Product is fully suited to the customer's requirements.

Continual operator inspection at each stage of the process and product, combined with the use of standard machine parameters and computerized machine monitoring ensures that the process is repeatable and consistent.

Each product is tailored to the specific customer's requirements, and a production specification is produced by the Technical Department. The felt produced is tested against the requirements of this document to concur suitable.

Process controls are described in Table 2.1.

Table 2.1

<u>Process</u>	<u>Control</u>	<u>Characteristic</u>
Opening fiber	Operator inspection, set parameters	Even density and thickness
Carding	Operator inspection, set parameters, computer feedback	Even fiber distribution
Tacker needling	Operator inspection, set parameters, computer feedback orientation of fibers	Permits controlled
Reorientation of fibers	Operator inspection, set parameters, computer feedback	Controls relative elongation moduli in length and cross directions
Needling	Operator inspection, set parameters, computer feedback	Density, strength, ability to weld

3. Polyurethane Coating of Felt

The sole consumable is granular polyurethane. The polyurethane specification is selected to ensure that the coating has the correct properties to meet the requirements of the customer.

Process controls are described in Table 3.1.

Table 3.1

<u>Process</u>	<u>Control</u>	<u>Characteristic</u>
Extrusion of polymer into Flat die	Fully automatic temperature, pressure control	Homogeneity of extrudate
Formation of molten polymer film	Operator control of machine temperatures, pressures, speeds	Coating uniformity
Transfer of molten film onto felt	Operator control of machine temperatures, pressures, speeds. Continual monitoring of coating thickness.	Coating mass per unit area Weight distribution over entire roll area.

4. Testing of Plain and Coated Felts

Each roll of plain felt and felt for coating is sampled and destructively tested against the requirements of the Production Specification as shown in Table 4.1. Each coated roll undergoes testing as Table 4.2.

Table 4.1

<u>Characteristic</u>	<u>Test</u>
Density and density distribution at various applied pressures	Compression measurement at increasing pressure
Load at break in machine and cross directions	Tensile testing- Maximum Resistive Force
Secant Modulus in machine and cross directions (resistance to stretch).	Tensile testing- Maximum Resistive Force vs Extension %

Table 4.2

<u>Characteristic</u>	<u>Test</u>
Density and density distribution at various applied pressures.	Compression measurement at Increasing pressure.
Load at break in machine and cross directions.	Tensile testing - Maximum Resistive Force
Secant Modulus in machine and cross directions (resistance to stretch)	Tensile testing - Maximum Resistive Force vs Extension %
Coating weight and distribution	Samples weighed to determine distribution of coating in cross direction of roll.
Coating adhesion and ability to weld.	Peel strength of welded tape (Standard specification)
Coating surface finish	Visual inspection

5. Production of Liners

Liner requirements are collected by way of the Customer Order and customer liaison, and are confirmed to the customer on our Order Acknowledgment form.

Once all requirements are known, a liner is designed which will fulfill all the requirements.

The design is detailed to the Production department as a Manufacturing Specification. This is then entered onto the Production Schedule.

The liner may be produced by one of a number of production techniques, depending on the requirements.

6. Testing the finished liner

The control and test of the liner properties are detailed in Table 6.1.

From each liner produced, a sample is cut from one end for QC inspection and test. This sample is destructively tested to ensure that all of the liner properties are within the Manufacturing Specification.

Table 6.1

Property	Control	Test
Circumference of liner	Monitored at each production stage against Manufacturing Specification	Destructive test of sample. All layers are measured.
Density, Gauge of liner under various applied pressures	Selection of felt layers in order that finished density and gauge are within Manufacturing Specification	Compression test of sample of all layers
Length of liner	Monitored at each production stage against Manufacturing Specification	Inspection regime includes measurement of a sample of liners against Manufacturing Specifications.
Coating Integrity	Continually monitored by state-of-the-art gauge.	Inspected after coating Monitored throughout liner manufacture
Metal Free	Needling process is continually monitored for alignment to prevent needle damage	Each roll passes through Metal Detection equipment
Felt Weld Strength	All welding equipment operates to set parameters. Overlapped thermal welded.	Each weld is sampled And destructively tested Results are compared to the Manufacturing Specification

Table 6.1 con't

Sealing Tape Weld Strengths

All welding equipment
operates to set parameters,
chemically bonded seal.

Each weld is sampled,
specially conditioned,
and destructively tested
under conditions
simulating the "worst
case" for that liner

Technical Information

Product: Polyurethane Coated Liner for Hot Cure Eversion

Specification

Felt:

The fiber is PET Polyester staple fiber.

The denier of the fiber for a standard hot cure eversion liner for vacuum impregnation with a polyester resin is usually selected as nominally 6 denier (+10%) (dependant on specific liner and installation details).

The felt is manufactured to a thickness specification of ± 3 % when measured at a compressive pressure of 0.5 bar (7.4 psi) (16 ft. water head). Standard thickness of 1.5 mm, 3mm, 4.5mm, 6mm exist.

Coating:

The coating is a thermoplastic polyester polyurethane. The nominal weight may be 300 – 400, 400 - 500, 500 - 600 or 600 - 700 grams per square meter. It is usual for the 300 - 400 gsm spec to be used. This affords an average coating thickness of 0.30mm for 376 gsm, 0.33mm for 400 gsm.

Liner:

The liner is assembled from layers of plain felt and an outer layer of coated felt. Each inner plain layer is overlapped approximately 50mm (2") at each joint and welded by hot fusion techniques to give the requisite weld strength to support the installation pressure (with a safety factor included). The safety factor is in excess of 2.

The outer coated layer has a high strength felt strip fusion welded across the inside of the joint and a sealing tape of polyurethane welded over the coating to give a seal and a barrier of comparable thickness to the coating.

The finished liner thickness is measured at the installation head and is toleranced at $-0 + 5\%$ on nominal ordered thickness.

CERTIFICATION

This certifies that Applied Felts manufactured tubes meet the material requirements of ASTM F1216-93. In support of ASTM D5035, specifically as it relates to tensile strengths, our liner tensile properties average 1100 psi. The minimum tensile strength is 750 psi as per ASTM D5813-95 item 6.1 *Fabric Tube Strength* (see Page 10). All our materials are tested to ensure suitability to the application. Each liner is typically tested in 28 different ways and traceable test data is available for any particular liner.

Recommendations for minimum, maximum and ideal pressures are provided for each and every liner that Applied Felts manufactures. This ensures that the installer understands the requirements for holding the tube against the existing conduit and the maximum allowable pressure so as not to damage the tube. A head pressure chart is attached as examples for various tube sizes.

Applied Felts has provided polymer coated felt tubes for use in Cured In Place Pipe (CIPP) lining for more than twelve years, and supplied materials for the CIPP industry for more than twenty years. Over 22 million feet of our liner has been successfully installed world wide, of which 10 million feet has been installed in the United States. Over 97,476 feet of our liner with diameter 36" and above have been installed in the U.S.

Applied Felts also certifies that all liners manufactured will meet the minimum requested finished thickness (or greater) as ordered by its customers.

Applied Felts is a registered ISO 9002 company.

FABRIC TUBE STRENGTH

BATCH	1809		8/15/07	
Roll #	Warp Break	Warp Modulus	Weft Break	Weft Modulus
1809/01	2250	10.42	2980	8.01
1809/02	2250	10.56	3110	7.19
1809/03	2210	9.83	2730	6.43
1809/04	2200	9.23	2940	5.96
1809/05	2210	10.53	3040	6.42
1809/06	2260	10.47	2910	6.20
1809/07	2330	10.61	2830	6.77
1809/08	2480	11.28	2870	7.41
1809/09	2240	10.64	2860	6.96
1809/10	2480	12.21	2920	7.68
1809/11	2230	11.02	2930	7.96
1809/12	2220	10.73	2940	7.83
1809/13	2370	12.32	2890	7.14
1809/14	2370	11.38	2860	6.94
1809/15	2320	11.80	2920	6.50
1809/16	2340	11.31	2900	7.45
1809/17	2380	12.24	2820	7.56
1809/18	2390	12.20	2820	7.28
1809/19	2190	9.82	2800	7.48
1809/20	2250	10.67	2700	6.27
1809/21	2000	9.47	2860	7.17
1809/22	2360	12.32	2750	6.91
1809/23	2260	11.72	2910	7.99
1809/24	2270	11.23	2970	7.66
1809/25	2320	10.39	2940	7.30
1809/26	2180	11.27	2800	6.83
1809/27	2320	10.72	2680	7.18
1809/28	2290	11.82	2930	6.54
1809/29	2280	10.92	3060	7.58
1809/30	2180	9.26	2840	6.94
1809/31	2220	9.59	2870	7.21
1809/32	2290	10.61	2860	7.69
1809/33	2250	10.27	2810	7.02
Average	2278	10.87		7.14
	1101 psi			

RECOMMENDED HANDLING AND STORAGE FOR LINERS

1 Avoid extremes of temperature.

Freezing may cause the coating structure to degrade locally, especially areas where the coating is in tension or compression, at bends and edges and immediately adjacent to seam welds.

Recommended storage temperature 5 to 35 degrees C.

Shelf life at this temperature: in excess of 1 year.

2 Avoid extremes of humidity.

Very high relative humidity (especially at high temperature such as tropical countries) will accelerate the hydrolysis of the polyurethane coating, consequently reducing the shelf life.

Recommended storage humidity 25% rh to 65% rh.

Shelf life at 65%, 35 degrees C: 1 year.

3 Avoid prolonged wet storage.

As with high humidity, the coating more susceptible to degradation at higher temperatures, and even further susceptible if pH of liquid in contact is below 7.

Wet storage is not recommended.

4 Avoid direct sunlight of incident UV radiation.

Prolonged exposure to ultra violet light will accelerate the degradation of the polyurethane.

It is recommended that liners remain in the original packaging until they are required for use. Failing this, the liner should be covered to prevent exposure.

5 Mechanical damage should be avoided.

In order to ensure that the liner is not damaged, the following recommendations should be followed:

- a) Ensure that liner is not placed directly onto grit or gravel floor. Sweep and cover floor first.
- b) Ensure personnel are instructed not to walk on liner.
- c) Handle liner with care.
- d) Ensure nip rollers clean, and liner is not in contact with any sharp edges or snags anywhere during impregnation and installation.
- e) Large liners will require special handling considerations (especially when wet-out), as their weight will preclude manual handling. Cranes or conveyors may be required. If a liner is to be lifted with a crane sling, it is important that the sling should be sufficiently wide to prevent it from "biting" into the liner. It should be set up in such a way that the sling does not grip the liner (ie. both loops of the sling onto the crane hook).

CONTRACTOR EXPERIENCE FORM

Provide list of experience per the requirements of Section 713, Paragraph 713.5 of the Special Provisions.

Failure to provide complete information on this form may deem your bid non-responsive.

1. PROJECT: Southern Ave WW Rehab DATE COMPLETED: 3/18/11
NAME OF OWNER: City of Mesa, AZ (SAK sub to B&F)
CONTACT PERSON: Tom Foley PHONE NUMBER: 623-582-1170
SIZE OF CIPP INSTALLED: <36" TOTAL LENGTH INSTALLED: 19,636 FEET
LONGEST INDIVIDUAL LENGTH OF CIPP INSTALLED: > 2000' FEET

2. PROJECT: South Rillito Intercept DATE COMPLETED: 6/25/14
NAME OF OWNER: Pima Co RWRD (SAK sub to KE&G)
CONTACT PERSON: Brian Janski PHONE NUMBER: 520-748-0188
SIZE OF CIPP INSTALLED: <54" TOTAL LENGTH INSTALLED: 11,396 FEET
LONGEST INDIVIDUAL LENGTH OF CIPP INSTALLED: > 2000' FEET

3. PROJECT: 2013 Sewer Rehab Ph II DATE COMPLETED: 09/05/13
NAME OF OWNER: City of Reno, NV
CONTACT PERSON: Mike Stram (Reno) PHONE NUMBER: 775-334-2350
SIZE OF CIPP INSTALLED: <72" TOTAL LENGTH INSTALLED: 43,364 FEET
LONGEST INDIVIDUAL LENGTH OF CIPP INSTALLED: > 2000' FEET

4. PROJECT: Small Diam San Sewer DATE COMPLETED: 04/04/14
NAME OF OWNER: City of Phoenix
CONTACT PERSON: Steve Fernandez PHONE NUMBER: 602-495-0724
SIZE OF CIPP INSTALLED: <15" TOTAL LENGTH INSTALLED: 62,870 FEET
LONGEST INDIVIDUAL LENGTH OF CIPP INSTALLED: > 1000' FEET

5. PROJECT: Vegas Dr. Sewer Rehab DATE COMPLETED: 03/01/14
NAME OF OWNER: City of Las Vegas (SAK sub to LVP)
CONTACT PERSON: Jake Marshall PHONE NUMBER: 702-467-2013
SIZE OF CIPP INSTALLED: <39" TOTAL LENGTH INSTALLED: 12,309 FEET
LONGEST INDIVIDUAL OF CIPP LENGTH INSTALLED: < 1000' FEET

SUPERINTENDENT QUALIFICATION FORM

Provide the name of the construction superintendent/superintendents to be assigned to the above stated project. Each qualified superintendent shall have a minimum of three (3) years CIPP lining supervisory field experience on a least 3 successfully completed projects containing at least a total of 3,000 LF of 6"-10" or larger CIPP liner including three (3) years flow diversion supervisory field experience per the requirements of Section 713, Paragraph 713.5 of Special Provisions.

Failure to provide complete information on this form may deem your bid non-responsive.

SUPERINTENDENT NAME: JEFF HOBERHOFER

1. PROJECT: Southern Ave WW Rehab DATE COMPLETED 03/18/11

NAME & ADDRESS OF OWNER: City of Mesa (SAK sub to B&F)

CONTACT PERSON: Tom Foley PHONE NUMBER 623-582-1170

SIZE OF CIPP INSTALLED: <36" TOTAL TIME ACTING AS SUPERINTENDENT: 12 MONTHS

INCLUDED FLOW DIVERSION? CHECK ONE YES ☒ NO ☐ 19,636' of 33"-36" CIPP

2. PROJECT: Downtown Interceptor DATE COMPLETED 10/11/11

NAME & ADDRESS OF OWNER: City of Las Vegas, NV (SAK sub to LVP)

CONTACT PERSON: Jake Marshall PHONE NUMBER 702-467-2013

SIZE OF CIPP INSTALLED: <54" TOTAL TIME ACTING AS SUPERINTENDENT: 12 MONTHS

INCLUDED FLOW DIVERSION? CHECK ONE YES ☒ NO ☐ 12,329' of 45"-54" CIPP

3. PROJECT: Sewer Rehab Group D DATE COMPLETED 10/01/11

NAME & ADDRESS OF OWNER: City of Las Vegas

CONTACT PERSON: Cory Schmidt PHONE NUMBER 702-229-6011

SIZE OF CIPP INSTALLED: <36" TOTAL TIME ACTING AS SUPERINTENDENT: 12 MONTHS

INCLUDED FLOW DIVERSION? CHECK ONE YES ☒ NO ☐ 13,332' of 15"-36" CIPP

4. PROJECT: Southern Ave Interceptor DATE COMPLETED 08/31/10

NAME & ADDRESS OF OWNER: City of Tempe, AZ (SAK sub to AGE)

CONTACT PERSON: Dan Broderick PHONE NUMBER 480-940-1300

SIZE OF CIPP INSTALLED: <48" TOTAL TIME ACTING AS SUPERINTENDENT: 12 MONTHS

INCLUDED FLOW DIVERSION? CHECK ONE YES ☒ NO ☐ 12,610' of 36"-48"



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Phoenix, AZ 85040
www.sakcon.com

SAK Construction, LLC – Key Personnel North Rillito Interceptor Rehabilitation

JEFF OBERHOFER Superintendent 30 YRS CIPP EXPERIENCE

Jeff has been involved in the successful installation of CIPP since 1984. He has overseen more medium and large diameter CIPP installation within the state of Arizona than anyone in the industry. Jeff will be responsible for all on-site personnel and equipment resources along with scheduling daily crew activities. ***He will be 100% dedicated to this project.***

BRIAN ACKERMAN Project Manager 2 YRS CIPP EXPERIENCE

Since joining SAK two years ago, Brian has been responsible for projects totaling over 200,000 feet of CIPP installation in Arizona and Southern Nevada. He was SAK's PM for the South Rillito Interceptor Rehab in 2014 which included 11,396' of 48"/54" CIPP. Brian will be responsible for day-to-day correspondence, planning, scheduling and construction management.

DAVID BURBANK Assistant Project Manager 1.5 YRS CIPP EXPERIENCE

Since joining SAK, David has assisted in the successful installation of nearly 100,000 feet of CIPP. He's been in the construction industry since 2003 and his experience prior to joining SAK compliments his day-to-day tasks in his current role. He will be responsible for submittal generation, permit acquisition, public notification, subcontractor management and maintaining project deliverables such as pre and post videos, daily reports, thermo-sensor logs and CIPP sample test results. ***David lives in Tucson and will be 100% dedicated to this project.***

JAMES BOWER CIPP Crew Leader 6 YRS CIPP EXPERIENCE

James has installed over 50 miles of CIPP in Pima and Maricopa Counties. He was the primary crew leader on the recently-completed South Rillito Interceptor Rehab project for PCRWRD. ***He will be 100% dedicated to this project.***

JOE FEUERBORN General Manager 16 YRS CIPP EXPERIENCE

Joe started in the sewer rehabilitation industry in 1996 and has since overseen the successful installation of over a thousand miles of CIPP. He's been directly involved in or provided oversight and support for CIPP projects in Arizona since 1999. He's ultimately responsible for all CIPP projects in SAK's Western Region.

RYAN BROYLES Operations Manager 21 YRS CIPP EXPERIENCE

As SAK's Western Region Operations Manager, Ryan is responsible for all CIPP crew personnel and equipment in the Western U.S. He's had direct oversight of the successful installation of several hundred thousand feet of CIPP. From 2001 to 2010 prior to joining SAK, Ryan supervised the installation of over 100,000 feet of medium and large diameter CIPP in Arizona. He knows the obstacles and the solutions to dealing with the temperature-sensitive CIPP product in the extreme heat.

TOM PETANOVICH General Superintendent 14 YRS CIPP EXPERIENCE

As a General Superintendent at SAK, Tom is responsible for the overall success of multiple crews in Arizona, California and Nevada. He started in the sewer rehabilitation industry in 2000 and has installed over a million feet of CIPP in the Western U.S.; including over 100,000' of CIPP in Arizona. In 2014, Tom was on site and helped coordinate the successful installation of 11,396 feet of 48"-54" diameter CIPP in Pima County.

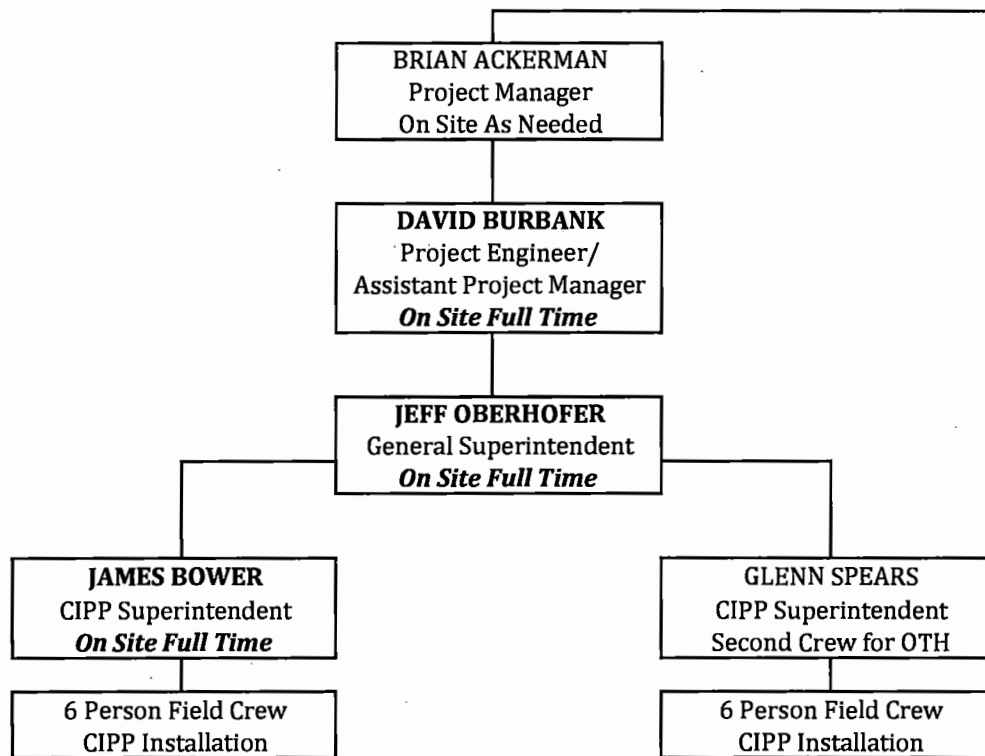


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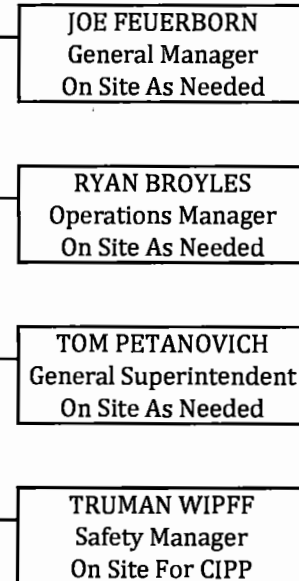
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SAK Project Org Chart North Rillito Interceptor Rehabilitation

LOCAL PROJECT MANAGEMENT



REGIONAL SUPPORT



Holiday

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