BUCKSKIN SANITARY DISTRICT

Phase 4 Wastewater Conveyance System
Design Report

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APPENDICES

I. INTRODUCTION

A. Purpose

This document amends the Final Design Report dated December, 2013 for the project known as the Phase 4 Wastewater Conveyance System. The design report was approved by ADEQ in February, 2014. The purpose of this addendum is to update the December, 2013 report by incorporating the designs of several additional neighboring communities that will be connected to the Phase 4 project. This report will serve as the basis of design for the preparation of detailed plans and specifications and will fulfill the requirements of ADEQ as it applies to the design of sewage collection systems per ACC R18-9-E301. 4.01.

The Design Report includes the appropriate design criteria used for the project, a summary of the wastewater flow projections for Phase 4, and an overview of the proposed sewer system design. The original design of the Phase 4 project approved by the Department remains fundamentally unchanged with the exception of a few minor revisions noted in this report.

B. Background

The District has been implementing a comprehensive plan to expand their collection and treatment system to serve the unsewered developed portions of the District's service area in general conformance with the District's Master Plan. The District currently provides sewer service to the areas designated as Phases 1, 2 and 3 which lie within the southern most portion of the southern planning area. The District has now developed plans to extend sewer service to the north to serve the remainder of the southern planning area.

In 1997 the District installed the Phase 1 wastewater collection system and acquired the Buckskin Wastewater Treatment Plant (WWTP). In 2007, the District began implementing the installation of the Phase 2 and Phase 3 wastewater collection system. These phases were completed in 2010. The existing collection system serving these communities lies south of the WWTP, while the remaining developments north of the plant remain un-served with the exception of the Boat Safety Training Center which lies immediately north of the plant.

The Master Plan dated 2007 prepared by Stanley Consultants, identified under Alternative 1 a separate collection system and treatment plant serving the southern planning area. This alternative included a series of gravity sewers, lift stations and force mains conveying wastewater to a new treatment plant located just south of the golf course and east of SR95. The proposed collection system layout described under Alternative 1 was used as a basis for further evaluation by the District. The collection system layout in the Master Plan identified the need for three lift stations serving the existing communities along SR95A. The Master Plan did not, however, address the manner in which each of the developments along SR95A would be served. The proposed conveyance system assumed that it would be the responsibility of each development to connect to the District sewer system whether it could do so by gravity or by pumping.

C. Previous Studies

The reports previously prepared by the District impacting Phase 4 include the following:

1. Wastewater Master Plan, Buckskin Sanitary District prepared by Stanley Consultants, Inc., August, 2007.
2. Wastewater Master Plan Update, Buckskin Sanitary District prepared by Carollo Engineers, Inc., August, 2011.
3. Design Concept Report, Buckskin Sanitary District prepared by Energy and Water Solutions, December, 2010
4. Preliminary Design Report of Area 4, Buckskin Sanitary District by Energy and Water Solutions, December, 2011

The Preliminary Design Report (PDR) of Area 4 (now known as Phase 4) evaluated conveyance alternatives and made recommendations regarding the design of a wastewater conveyance system necessary to provide sewer service to the existing communities along SR95A. This report provided the basis for the District to make a final decision to proceed with servicing Phase 4.

D. Findings

The design of the sewage collection system has been completed under the direction and review of Glenn A. Panaro, P.E. (Arizona Registration # 42251). Mr. Panaro has determined that the Project can be adequately served by a sewage collection system, as shown herein and as depicted in the engineering plans shown in the design package provided herewith that the proposed system meets generally accepted engineering standards for the collection of sewage, and requirements of the ADEQ.

II. PROJECT LOCATION AND DESCRIPTION

A. Project Location

The Phase 4 Wastewater Conveyance System is located to the north of Parker and south of the Parker Dam. The majority of the existing development to be served by this project generally lies on the eastern shore of the Colorado River between the river and SR95A (Riverside Drive). This design report encompasses the existing development north of the Boat Safety Training Center extending north along SR95A for approximately 3.2 miles to the Rio Lindo development. The general vicinity of the project is shown on Figure 1 – Location Map (see Appendix 1). A map showing the Phase 4 Planning Area project limits can be found on Figure 2 – Project Map (see Appendix 1).

B. Project Description

The proposed backbone conveyance system consists of a series of 8-inch and 10-inch gravity collector sewers, 4-inch, and 6-inch force mains running south in the R.O.W. of SR95A. Three (3) lift stations will convey wastewater from the northern portion of the southern planning area to the Buckskin WWTP. Lift Station No. 1, which will be located in the Rio Lindo development, consists of demolishing and abandoning the existing lift station and septic tanks at Rio Lindo and constructing a new District owned lift station which will be sized to serve the existing communities in the northern region of the southern planning area. Lift Station No. 2 will be located at the north end of La Paz County park on the west side of SR 95A south of Roadrunner's entrance. Lift station No. 3 will be located approximately 240 feet east of SR95A just south of Golf Course drive near the District's effluent holding ponds. Lift Station No. 3 will convey all anticipated flows generated by the Phase 4 conveyance system project to the Buckskin WWTP.

1. Backbone Conveyance System

The backbone conveyance system is sized to accommodate existing and future wastewater flows from the Phase 4 communities but will not be sized to handle wastewater flows from the northern planning area. The District is currently planning a separate wastewater treatment plant and conveyance system to serve the northern planning area (Phases 5 & 6).

a. Backbone System at Rio Lindo Area - The backbone conveyance system serving the Rio Lindo area development and surrounding communities is described as follows:

An 8-inch gravity sewer, approximately 174 feet in length, will be constructed from the existing terminal manhole (EXMH) in the Rio Lindo development to a proposed manhole (MH#26) located in the entrance of Rio Lindo and SR95A. This will provide a means of connecting future wastewater flows generated by Fox's and Sandbar at Red Rock to the south and the Sundance Resort to the north. The existing lift station in the Rio Lindo development, which currently conveys wastewater flow from septic tanks to an existing leach field located across SR95A, will be abandoned and a new lift station, known as Lift Station No.1 will be constructed in its place by the District. Lift Station No.1 will be owned and operated by the District.

Lift Station No.1 is sized to handle all existing wastewater flows including peak flow rates generated from the surrounding area. Existing and future wastewater flows are addressed under Section 4 of this report. The lift station will discharge into an existing 4-inch force main in the Rio Lindo development. This force main will then be extended and run along SR95A in a southerly direction within the SR95A right-of-way for an additional 4,200 feet at which point it will discharge into an 8-inch gravity sewer manhole (MH #25) originating at the north end of Marina Village North also located in the SR95A right-of-way.

2-inch PVC force mains will be installed in a parallel trench with the 4-inch force main to be able to serve the existing RV parks known as Fox's and Sandbar, which lie directly south of the Rio Lindo development. This will allow both entities to pump sewage north thru the 2-inch force main and connect to the proposed gravity sewer manhole (MH#26), located at the entrance of Rio Lindo and SR95A, which conveys sewage to Lift Station No.1. The District will construct 1,045 linear feet of 2-inch PVC force main serving Sandbar Resort and 81 linear feet of 2-inch PVC force main serving Fox's in the SR95A right-of-way under the backbone project. A separate 2-inch PVC force main, approximately 538 linear feet, will also be installed on the north side of Rio Lindo Shores Drive in the County right-of-way to serve the Sundance Development and two individual connections. This 2-inch force main stub will also connect to the gravity sewer at (MH#26).

b. Backbone System at Marina Village Area- The backbone conveyance system serving the Marina Village development and surrounding communities is described as follows:

The 4-inch force main from Lift Station No.1 will discharge into an 8-inch gravity sewer manhole (MH#25) on SR95A and will run south for approximately 1,081 feet before increasing in size from an 8-inch to a 10-inch sewer. The 10-inch line will run an additional 1,647 feet south in the SR95A right-of-way and discharge into Lift Station No.2.

Lift Station No.2 is located at the north end of La Paz County park on the west side of SR95A. The gravity sewer will have the capacity to convey all wastewater flows generated by the developments to the north. Lateral connections will be included along this line for the homes and businesses fronting SR95A. A combination of 4-inch building connections and 8-inch sewer stubs will be provided along the gravity sewer to serve each development on both the east and west sides of SR95A. In such cases where gravity service is not feasible, force main connections will be made to the sewer stubs provided by the District.

Lift Station No. 2 is sized to handle all existing wastewater flows including peak flow rates generated from the surrounding development and the upstream development (Rio Lindo area). Existing and future wastewater flows are addressed under Section 4 of this report. Lift Station No. 2 will discharge into a 6-inch force main and will run along SR95A in a southerly direction for approximately 5,126 feet at which point it will discharge into a 10-inch gravity sewer manhole (MH#11) originating at the south end of La Paz County Park.

c. Backbone System at Branson Area - The proposed backbone conveyance system serving the Branson Resort and surrounding communities is described as follows:

As previously noted, the 6-inch force main from Lift Station No. 2 will discharge into a 10-inch gravity sewer manhole (MH#11) originating just north of Branson Resort on the south end of La Paz County Park. This gravity line will run in a southerly direction within the SR95A ROW for approximately 538 feet into MH#6 where it will cross SR95A and parallel Golf Course drive for approximately 240 feet where it will discharge into Lift Station No. 3. Lift Station No. 3 is located approximately 240 feet east of SR95A just south of Golf Course drive near the District's effluent holding ponds. In order to provide service to the existing developments south of Branson Resort, a second 10-inch gravity line will be constructed. This line originates just south of Strokes restaurant adjacent to Patria Flats Park and runs north for approximately 1,480 feet and discharges into the same receiving manhole (MH#6) which also accepts sewage from the north.

Lift Station No. 3 will be sized to handle all existing wastewater flows including peak flows generated from the surrounding communities and upstream developments in the Phase 4 planning area. Existing and future wastewater flows are addressed under Section 4 of this report. Lift Station No. 3 will discharge into a 6-inch force main which will run along SR95A in a southerly direction for approximately 8,118 feet and discharge directly into the influent manhole of the Buckskin WWTP.

2. Community Collection Systems

The existing communities within the Phase 4 project area are currently served by a variety of on-site septic systems. Some are served by individual on-site systems and others are served by community systems with a combination of one or more septic tanks and leach fields. The individual needs of the communities dictated the proposed design activities described herein. For instance, Rio Lindo has an existing collection system and therefore does not require the design of a new collection system.

The District has made every attempt to accommodate the communities in the design of the backbone system so that the majority of the developments can be served by gravity. The District caused the design to accommodate the individual needs of the surrounding communities within reason. There may be, however, some instances within the overall project that the District is unable to accommodate a specific area by gravity. As a result, these properties will require a pumping system to be served.

> Note: The following statement applies to all future service connections in the Phase 4 Sewer Project.
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> ***In October, 2014 the District received notification from the USDA – Rural Utility Service (RD) that funding was approved for the development of the Phase 4 project. Subsequently, in January, 2015, the District was notified again by RD that the existing residences within the Phase 4 project, which were identified in the PER, are eligible for additional funding under the District's Colonia designation. RD has informed the District that, if approved, the funding level is a 100% grant.***
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> ***The District will either construct sewer stubs to the right-of-way or property line, or construct an internal collection sewer where easements have been granted to the District. The District will not make individual service lateral connections to any existing commercial or business as part of the Phase 4 Sewer Project.***
>
> ***Commercial and business owners will be responsible to hire their own qualified contractor (as pre-qualified by the District), to abandon their own existing septic and leach fields in accordance with ADEQ guidelines at the time they make connection to District facilities. The property owner will be required to obtain the necessary permits from La Paz County and Buckskin Sanitary District prior to construction and provide the necessary inspections when making connection to the District facilities in accordance with the Buckskin Sanitary District Code.***

Following is a summary of the major components of the community systems contributing to the backbone sewer system.

a. Rio Lindo Area

The existing communities/developments of Rio Lindo, Fox's RV Park, Sandbar at Red Rock and Sundance comprise the Rio Lindo Area, which is located in the extreme northern section of the southern planning area. The topography in the vicinity of Rio Lindo demands that a lift station and force main be constructed to serve these existing communities. Excessive depths would be required to maintain a gravity sewer line between Rio Lindo south to Marina Village. The District therefore determined that a lift station and force main would be in the best interests of those served.

1. Rio Lindo development is currently served by an existing collection system, community septic tanks, pumping station, and leach field. The existing collection system will remain in place. As previously discussed, the District will construct the proposed Lift Station No. 1 at the current pumping site. As a result, the existing septic tanks will be demolished and removed as part of the Phase 4 improvements. A portion of the existing 4-inch force main will be used for service and the remaining segment of the force main and leach field will be abandoned as noted on the sewer plans in accordance with ADEQ guidelines.

2. Fox's and Sandbar at Red Rock, which lie south of Rio Lindo are each served by an existing collection system, community septic tanks and leach fields. Fox's and Sandbar will each be required to install a lift station and force main to convey wastewater thru a 2-inch force main stubbed to the property line (mentioned above) to be installed by the District along and within the SR95A right-of-way. The septic tanks and leach fields will be abandoned per ADEQ guidelines, by the respective owners of the property, at the time they make connection to the 2-inch force main stubbed out to the property line as part of the Phase 4 improvements.

3. Sundance, which lies directly north of Rio Lindo, will be required to connect to the 2-inch PVC force main stubbed out to their property line when made available as part of the Phase 4 improvements. This 2-inch force main will discharge into the Rio Lindo gravity sewer system manhole (MH#26). .

b. Marina Village Area

The existing communities comprising the Marina Village area are discussed below in further detail. As stated previously, individual building connections will be constructed to the right-of-way, property line or established easement as shown on the plans. The individual property owner will be required to connect individual residences, utilizing a District qualified contractor, to the proposed gravity sewer collection system when the system is made available to them. A brief description of the proposed gravity sewer system serving each community evaluated within the Marina Village area is addressed below:

1. Marina Village North, which lies on the west side of SR95A is currently served by individual on-site systems. A gravity sewer system will be installed and connected to the backbone system along SR95A. The proposed plan consists of a conventional gravity sewer system

containing approximately 924 linear feet of 8-inch PVC sewer pipe in the roadway. Each individual homeowner will be required to connect to the sewer line through a 4-inch service line that will end at the property line. The gravity sewer system serving Marina Village North will convey wastewater and connect into Manhole No.'s 19 & 21 of the backbone system located on SR 95A and as shown on the plans. The proposed sewer system serving Marina Village North was previously approved by the Department on February 24, 2014 (ADEQ File No. 20130316).

2. Marina Village, which lies south of Marina Village North also on the west side of SR95A is currently served by a gravity sewer system, septic tanks and leach fields. The District will provide a gravity sewer system to serve the existing community. The proposed plan consists of a conventional gravity sewer system containing approximately 351 linear feet of 8-inch PVC sewer pipe in the roadway. Marina Village will abandon the septic tanks, lift station and leach fields in accordance with ADEQ guidelines and discharge into the new sewer system. The gravity sewer system serving Marina Village will convey wastewater and connect into Manhole No. 16 of the backbone system located on SR 95A, and as shown on the plans.

3. Marina Village Annex, is a subdivision with private streets, which lies on the east side of SR95A and is currently served by individual on-site systems. The HOA has granted the District its request to dedicate easements necessary for the installation of a sewer collection system to serve their community. A gravity sewer collection system will therefore be installed and connected to the backbone system along SR95A. The District will include the sewage collection system serving this community as part of the Phase 4 Sewer Project and will ultimately own and maintain the sewer collection system. The proposed plan consists of a conventional gravity sewer system containing approximately 3,582 linear feet of 8-inch PVC sewer pipe and 114 linear feet of 6-inch PVC sewer pipe in the roadway. Each individual homeowner will be required to connect to the sewer line through a 4-inch service line that will end at the property line. The gravity sewer system serving Marina Village Annex will convey wastewater and connect into Manhole No. 18 of the backbone system located on SR 95A, and as shown on the plans. The proposed sewer system serving Marina Village Annex was previously approved by the Department on February 24, 2014 (ADEQ File No. 20130315).

4. Roadrunner RV Park, which lies on the west side of SR95A south of Marina Village on private property, is currently served by an existing sewer system(s), septic tanks and leach fields. The District will provide a gravity sewer system to serve the existing community. The proposed plan consists of a conventional gravity sewer system containing approximately 533 linear feet of 8-inch PVC sewer pipe in the roadway. Roadrunner will be required to disconnect their existing septic systems and connect to the proposed sewer system at the locations designated on the plans. Roadrunner will abandon the septic tanks and leach fields in accordance with ADEQ guidelines. The gravity sewer system serving Roadrunner will convey wastewater and connect into Manhole No. 13 of the backbone system located on SR 95A, and as shown on the plans.

5. Arete Road, which lies on the east side of SR95A directly north of Marina Village Annex, is currently served by individual on-site systems and is located on private streets. The District will provide a gravity sewer system to serve the existing community. The proposed plan

consists of a conventional gravity sewer system containing approximately 704 linear feet of 8-inch pipe (250 lf of PVC and 454 lf of DIP) and 100 linear feet of 6-inch PVC sewer pipe in the roadway. Property owners will be required to disconnect their existing septic systems and connect to the proposed sewer system at the locations designated on the plans. Property owners will abandon their septic tanks and leach fields in accordance with ADEQ guidelines. One homeowner will be required to use a grinder pump to convey waste to the collection system. The gravity sewer system serving Arete Road will convey wastewater and connect into Manhole No. 20 of the backbone system located on SR 95A, and as shown on the plans.

c. La Paz County Park

1. La Paz County Park is situated on the west side of SR95A and runs south from Roadrunner RV Park for approximately one mile. The County will ultimately be required to construct a sewer system to serve the needs of the park and connect into the backbone gravity sewer on either the south or north ends of the park. The District will provide 8-inch sewer stubs on both the north and south ends of the park. La Paz County will be required to connect their existing system(s) by either gravity, pumping or a combination thereof, utilizing a District qualified contractor, to the proposed backbone gravity sewer collection system when the system is made available to them

2. Pirate's Den RV Resort and Marina is located within the La Paz County Park and is currently being served by an interim vault and haul system until they are able to connect to the District's Phase 4 backbone sewer system. Pirate's Den will be allowed to connect to either Manhole #11 or pump directly into the force main of the District's proposed backbone system when the system becomes operational.

d. Branson Resort Area

The existing communities comprising the Branson Resort area are discussed below in further detail:

1. Branson Resort, which lies on the west side of SR95A just south of La Paz County Park is currently served by an on-site community sewer system(s), septic tanks and leach fields. The District will provide a gravity sewer system to serve the existing community. The proposed plan consists of a gravity sewer system containing approximately 1,340 linear feet of 8-inch PVC sewer pipe in the roadway. Branson Resort will be required to disconnect their existing septic systems and connect to the proposed sewer system at the locations designated on the plans. Branson will abandon the septic tanks and leach fields in accordance with ADEQ guidelines. The design also consists of an additional 691 linear feet of 8-inch sewer line serving five vacant parcels known as River's Edge. This gravity sewer system will convey wastewater and connect into Manhole No.'s 5 & 7 of the backbone system located on SR 95A, and as shown on the plans.

2. Jolly Knight RV Park, a single parcel of land, which lies on the west side of SR95A, south of Branson Resort is currently served by an existing sewer system(s), septic tanks and leach fields. The District will provide a gravity sewer system to serve the existing community. The proposed plan consists of a conventional gravity sewer system containing approximately 605 linear feet of 8-inch and 100 linear feet of 6-inch PVC sewer pipe in the roadway. Jolly Knight

will be required to disconnect their existing septic systems and connect to the proposed sewer system at the locations designated on the plans. Jolly Knight will abandon the septic tanks and leach fields in accordance with ADEQ guidelines. The gravity sewer system serving Jolly Knight will convey wastewater and connect into Manhole No. 4 of the backbone system located on SR 95A, and as shown on the plans. Jolly Knight will also provide a means for Desert Star to convey their waste to the sewer system. This is explained in further detail below

3. Desert Star RV Park, which lies on the west side of SR95A directly south of Jolly Knight, is currently served by an existing sewer system(s), septic tanks and leach fields. This community is unique in that there are a few privately owned parcels adjacent to the Colorado River that access their properties through the Desert Star RV Park by means of an ingress/egress easement. The District will provide a gravity sewer system to serve the existing community. The proposed plan consists of a conventional gravity sewer system containing approximately 424 linear feet of 8-inch PVC sewer pipe. The sewer system serving Desert Star was previously approved by the Department (ADEQ File No. 20130317); however, an easement to convey wastes to the backbone system was not attainable, and wastewater will have to be conveyed through an 8-inch sewer linking Desert Star system to Jolly Knight's system. Desert Star will be required to disconnect their existing septic systems and connect to the proposed sewer system at the locations designated on the plans.

4. Plantation Resort, which lies on the west side of SR95A, south of Desert Star, is currently served by an existing sewer system, septic tank and leach field. Plantation's septic tank and leach field are actually located on County property (Patria Flats) just south of the resort. For this reason, the District will provide a gravity sewer system on County property to serve both Plantation resort and the park at Patria Flats. The proposed plan consists of a conventional gravity sewer system containing approximately 470 linear feet of 8-inch PVC sewer pipe on the north end of the park. Plantation will be required to disconnect their existing septic system in accordance with ADEQ guidelines and connect to the proposed sewer system at the location designated on the plans. The District will also provide an 8-inch stub at the terminal manhole for future service to Patria Flats Park. The gravity sewer system serving Plantation and Patria Flats will convey wastewater and connect into Manhole No. 2 of the backbone system located on SR 95A, and as shown on the plans.

5. Patria Flats, which is part of the La Paz County park system, has no known on-site treatment facilities. As mentioned, the District will provide an 8-inch stub at the terminal manhole (MH #1), located near the north end of the park adjacent to Plantation Resort to serve the future needs of the park. La Paz County will be required to connect their existing system(s), if any, by either gravity, pumping or a combination thereof, utilizing a district qualified contractor, to the proposed gravity sewer collection system when the system is made available to them.

See Appendix 2 for the overall Project Site Drawings.

III. BASIS OF DESIGN

The Basis of Design used for this project relied on the criteria contained within the Arizona Administrative Code (AAC), ADEQ Engineering Bulletin No. 11, Maricopa Association of Governments (MAG) standards, and the Buckskin Sanitary District's Sanitary Code and Sewer System Technical Standards and Specifications.

A. Gravity Sewer Design Criteria

The design criteria for the gravity sewer collection and conveyance system are summarized in Table 1. below.

Table 1. Gravity Sewer Design Criteria

Parameter	Design Criteria	Source
Sewer Depth of Cover	6'-0" minimum	BSD Standards
	3'-0" minimum under roadways	AAC R18-9-E301 4.01(D)(2)(b)
Pipe Radius (if curved)	200' minimum	AAC R18-9-E301 4.01(D)(2)(a)
Pipe Size	8-inch minimum; 6-inch (dead ends)	AAC R18-9-E301 4.01(D)(2)(d); (d)(i)
Minimum Slope (ft/ft)	0.0033 (8-inch)	ADEQ Bulletin No. 11
Manning Roughness Coefficient	n=0.013	AAC R18-9-E301 4.01(D)(2)(e)
Minimum Pipe Velocity	2.0 fps Flowing Full	AAC R18-9-E301 4.01(D)(2)(e)
Maximum Pipe Velocity	10.0 fps Peak Flow	AAC R18-9-E301 4.01(D)(2)(f)
Maximum Depth of Flow in Pipe	0.75 d/D	AAC R18-9-E301 4.01(D)(2)(e)(iii)
Manhole Spacing	Maximum 500 feet (8-inch pipe)	AAC R18-9-E301 4.01(D)(3)(a)
Manhole Size	4' Diameter	MAG Standard Details (Latest Revision)
	5' Diameter depth > 10'	BSD Standards
Drop Manholes	Used when invert difference exceeds 2.5'	MAG Standard Details Latest Revision)
Lateral Slopes	1/4-inch/foot minimum	MAG Standard Details (Latest Revision)
Lateral Sizes	4 inch	MAG Standard Details (Latest Revision)
Material	SDR35 PVC	ASTM D3034; BSD Standards
Wash Crossings	Concrete encased PVC	Depth will vary per BSD Standards

B. Force Main Design Criteria

The force main design criteria for the project are summarized in Table 2. below.

Table 2. Force Main Design Criteria

Parameter	Design Criteria	Source
Minimum Velocity	3.0 feet per second	AAC R18-9-E301 4.01 (D)(4)
Maximum Velocity	7.0 feet per second	AAC R18-9-E301 4.01 (D)(4)
Material	PVC Pressure Pipe <3-inch pipe: Sch 80	AWWA C900 , 905; DR 18 BSD Standards
	DIP for Floodway Crossings	AAC R18-9-E301 4.01(D)(2)(c) AWWA C150

Force main design shall include drain back prevention, air release valves, restrained joints or thrust blocks (where needed), and designed to withstand a working pressure plus 50 psi during testing in accordance with AAC R18-9-E301 4.01 (D)(4).

C. Lift Station Design Criteria

The lift station design criteria for the project are summarized in Table 3. below.

Table 3. Lift Station Design Criteria

Parameter	Design Criteria	Source
Wet well volume	(Q x t) / 4	AAC R18-9-E301 4.01(D)(5)(c)
Wet well diameter	6 foot minimum (unless approved by District)	BSD Standards
Retention Time	Maximum - 30 minutes (Minimum – 5 minutes)	AAC R18-9-E301 4.01(D)(5)(c)
No. of Pumps	2 pumps (minimum) capable of passing a 2.5 inch sphere. Pumping systems shall have at least one redundant pump	AAC R18-9-E301 4.01(D)(5)(d); BSD Standards
Standby Power	Automatically power lift station if the main power source fails; Fixed standby generator	AAC R18-9-E301 4.01(D)(5)(f) BSD Standards

In accordance AAC R18-9-E301 4.01(D)(5), lift station designs shall include a warning sign with 24 hour emergency phone number, high and low level alarms, standby power source, and redundant wastewater level controls that provide immediate service and remain available for 24 hours per day in the event the main power source or controls fail. Lift stations must be designed to prevent odor from emanating beyond the lift station site. Lift stations shall not be constructed in a floodway.

Each of the three lift stations is equipped with two non-clog submersible pumps located in pre-cast concrete wet well structures. Each lift station is capable of operating at peak design flow with any one pump out of service. If a malfunction occurs with any of the equipment, appropriate alarms will activate that include a local emergency light in addition to auto dialer system equipment. Wet well draw down levels can be adjusted by the operator to account for low flow conditions to minimize retention time in the wet well and, if necessary, increase draw down levels to reduce the number of pump starts.

The odor control unit shall draw contaminated air from the enclosed space being scrubbed into a mixing chamber and through an air diffuser which precedes the converter media chamber, then through the oxidizing chamber, which precedes the final polishing chamber and exhausting to atmosphere. Greater than 99.5 percent of H_2S shall be removed by the scrubber. Any potential odors emanating from the force mains will be handled by chemical injection into the wet well. Table 4 lists the performance criteria for the odor control for this project:

Table 4. Odor Control Design Criteria

Parameter	Design Criteria
Peak influent H2S concentration	100 ppm
Average Day treatment	Varies by Lift Station
Air changes per hour	Four (4) Minimum
Stack outlet H2S concentration	0 ppm maximum
H2S removal	99.9% minimum

IV. WASTEWATER FLOW PROJECTIONS

A. Wastewater Design Flow Basis

The actual population of the existing communities in the southern planning area is significantly less than indicated in the 2007 Master Plan and 2011 Master Plan Update. Wastewater flow projections forecasted in the Preliminary Design Report (Dec. 2011) were based on a field survey that counted the actual number of existing lots that will generate wastewater flow to the Buckskin WWTP. Based on 2.34 persons/dwelling (ADEQ minimum requirements) an existing population of 1,582 persons is estimated for Phase 4.

B. Existing Wastewater Flow Projections

1. Buckskin WWTP Flows

Daily wastewater flows are recorded at the Buckskin WWTP. Actual monthly flows for the period beginning December, 2012 thru November, 2013 are displayed in Table 5 (See Appendix 3). The average monthly wastewater flow at the Buckskin WWTP for this period was 45,098 gpd. The maximum monthly flow recorded for this period was 50,416 gpd in January, 2013. It is not uncommon for a treatment plant to experience monthly flows this low due to the seasonal nature of the population served. It is apparent that the vacancy rate has a profound impact on wastewater flows generated. This is substantiated in the La Paz County 2010 Comprehensive Plan.

2. Existing Development (Southern Planning Area)

The wastewater flow projections for the existing development in the southern planning area have been broken down into two categories. The first category is the actual sewage flow being generated in Phases I-III for treatment at the Buckskin WWTP. This is considered the “Baseline Flow” since the collection system has already been built and connected to the treatment facility. The second category is the projected wastewater flow that will be generated from the new conveyance system serving Phase 4, which is the remaining component of the Southern Planning Area.

The Arizona Department of Environmental Quality (ADEQ) has previously reviewed and accepted the method for determining the actual baseline flow for the Buckskin WWTP. The wastewater flow projections for the remaining Phase 4 conveyance system have been estimated in accordance with ADEQ requirements. Pursuant to A.C.C Title 18, Ch. 9., the base design flows for components of the Phase 4 conveyance system will utilize the unit flows specified in Table 1, Unit Design Flows. (See Appendix 3 for a copy of Table 1, Unit Design Flows).

The baseline flow for the Buckskin WWTP was approved by ADEQ in February, 2014. The approved commitment list is displayed in Table 6 below.

Table 6

Development Name	Design Flow at Buildout (gpd)	Date of Commitment
Baseline Flow (1)	50,416	Nov. 2013
Rio Lindo	6,545	Feb. 2014
Fox's	7,061	
Sandbar	10,409	
Sundance	1,787	
Marina Village	9,350	
Marina Village North	4,720	Feb. 2014
Marina Village Annex	19,656	Feb. 2014
Roadrunner	6,222	
Arete Rd	1,496	
La Paz	21,300	
Branson	19,688	
Jolly Knight	5,949	
Desert Star	2,620	Feb. 2014
Plantation	3,444	
Casino Beach	374	
BMB Storage	561	
River's Edge	935	
Strokes	1,250	
TOTAL	**173,783**	
	Total Committed Flow	**83,957 gpd**
	Total Permitted Flow	228,000 gpd

Note 1: The Baseline flow in 2013 is the maximum monthly flow recorded at the Buckskin WWTP over a 12 month duration.

An updated commitment list is being submitted to ADEQ with this application for an Approval to Construct. Upon approval of the respective applications for the community sewer designs contained herein, the District will finalize this list in accordance with ADEQ guidelines.

b) Projected Wastewater Flow

The projected wastewater flow for Phase 4 is indicated in Table 6.1 below.

Table 6.1

WASTEWATER FLOW PROJECTIONS FOR PHASE 4 CONVEYANCE SYSTEM				
Phase 4 Development	Number of Maximum Connections			Projected Flows (gpd)
	Homes (1)	RVs (2)	Commercial (3)	
Rio Lindo Area	46	147	2,500	25,802
Marina Village Area	227	36	1,500	47,549
La Paz County Park	-	187	2,600	21,300
Branson Resort Area	110	125	1,250	34,320
			Projected Flow	**= 128,971 gpd**

Basis

(1) 80 gpcd x 2.34 persons/dwelling (187 gpd)
(2) 100 gpd/ RV(vehicle space)
(3) Per ADEQ design table (estimated)

Breakdown

Residential = 121,121
Commercial = 7,850
Subtotal = 128,971 gpd

c) Total Projected Wastewater Flow for the Southern Planning Area

The combination of the baseline flow of 50,416 gpd and the projected flow of 128,971 gpd generated by Phase 4 equals the total projected wastewater flow of 179,387 gpd for the Southern Planning Area.

3. Capacity of the Buckskin WWTP

The District is authorized to operate the Buckskin WWTP under an existing Aquifer Protection Permit (APP) Number: P-100804, which was issued in May 2000 and amended in October 2003 and again in 2012. The APP permit allows the District to operate the Buckskin WWTP with a maximum average monthly flow of 228,000 gallons per day (gpd). All treated effluent is reused under a Type 2 Reclaimed Water Permit. Effluent produced by the treatment plant must meet Class A reclaimed water standards required by Arizona Administrative Code (AAC).

As displayed in Table 6 above, the total committed flow for the Buckskin WWTP is 83,957 gpd. This includes the Construction Authorizations issued by ADEQ on February 24, 2014 for Phase 4. In essence, the available capacity is equal to the difference between the permitted flow of 228,000 gpd and the committed flow of 83,957 gpd. This amounts to approximately 144,043 gpd of available capacity. Since the projected wastewater flow of 47,084 gpd for the cumulative NOI applications being submitted herein for Phase 4 is less than 177,584 gpd, the District can proceed with the submission of applications to construct proposed collection systems serving Phase 4. The remaining unallocated flow will be held in reserve by the District for the remaining sewer connections summarized in Table 6 above. It should be noted that the projected wastewater flow of 128,971 gpd for Phase 4 is based on all communities generating sewage flows at full capacity.

C. Future Wastewater Flow Projections

Due to the limited capacity of the Buckskin WWTP, based on current ADEQ requirements the District's first priority is to provide sewer service to the existing development in the southern planning area. Based on the wastewater flow rates previously recorded, the projected actual maximum monthly flow, once Phase 4 is connected, will most likely be in the range of 120,000 – 135,000 gpd. Any future expansion that causes the Buckskin WWTP to exceed 250,000 gpd in plant capacity would trigger compliance with current BADCT requirements per AAC R18-9-A211(B).

V. SEWER SYSTEM DESIGN

A. Overview

Per Article II, Section 3 of Buckskin Sanitary District's Sanitary Code, when sewer service becomes available, the construction, maintenance, or use of cesspools, septic tanks, or other means of sewage disposal are hereby abated. Property owners and facilities within the District will be required to connect to the wastewater conveyance system once it is constructed, accepted and operational and the existing on-site disposal systems will be required to be abandoned per local, county and federal requirements.

The District's existing wastewater collection system currently includes Phases 1, 2 and 3. Phase 1 was constructed in 2002, and Phases 2 and 3 were constructed in 2008. All phases are currently in service. All wastewater from Phases 2 and 3 is conveyed to the Phase 1 collection system at a manhole (MH#95-1) located at the intersection of Moovalya Estates Drive and Riverside Drive (SR95A). From this point all wastewater is conveyed to the existing Buckskin WWTP.

The Phase 4 Wastewater Collection System is located north of the Buckskin Sanitary District WWTP and south of the Buckskin Mountain State Park. The majority of the existing development to be served by this project generally lies on the eastern shore of the Colorado River between the river and SR95. The proposed backbone conveyance system consists of a series of 8-inch and 10-inch gravity collector sewers, 4-inch and 6-inch force mains running south in the ROW of SR95A.

Three (3) lift stations are proposed for this Project. The northern most lift station, Lift Station No.1, will be located within the Rio Lindo development. The existing pump station, septic tanks and leach field serving the Rio Lindo development will be taken out of service and removed. A new lift station will be constructed by the District in its place and will be sized to serve the existing communities in the northern region of the southern planning area known as the Rio Lindo Area.

The second lift station, Lift Station No. 2, will be located at the north end of La Paz County park on the west side of SR95A just south of Roadrunner's entrance. The main lift station, Lift Station No. 3, will be located approximately 240 feet east of SR95A just south of Golf Course drive near the District's effluent holding ponds. This lift station will convey all anticipated flows generated between the Rio Lindo area south to Patria Flats Park to the Buckskin WWTP.

The major components of the backbone sewer project are included in Table 7 below.

Table 7. Phase 4 Backbone Project Description

DESCRIPTION	UNIT	QUANTITY
8-inch Dia. Gravity Sewer	LF	1,634
10-inch Dia. Gravity Sewer	LF	3,991
2-inch Dia. Force Main	LF	1,882
4-inch Dia. Force Main	LF	4,200
6-inch Dia. Force Main	LF	13,261
4-foot Dia. Manholes	EA	2
5-foot Dia. Manholes	EA	23
Lift Station No. 1 at Rio Lindo	EA	1
Lift Station No. 2 at Marina Village	EA	1
Lift Station No. 3 at Branson Resort	EA	1

The major components of the community sewer systems are included in Table 7.1 below. These include the following proposed sewer systems:

- Marina Village North (approved by ADEQ)
- Marina Village Annex (approved by ADEQ)
- Marina Village
- Arete Road
- Roadrunner RV Park
- Branson's Resort/River's Edge
- K-Storage
- Jolly Knight/Desert Star (DS previously approved by ADEQ; revised herein)
- Plantation/Patria Flat

Table 7.1 Phase 4 Community Project Description

DESCRIPTION	UNIT	QUANTITY
8-inch Dia. Gravity Sewer	LF	10,067
6-inch Dia. Gravity Sewer	LF	340
4-foot Dia. Manholes	EA	40
5-foot Dia. Manholes	EA	4
Cleanouts	EA	13
4-inch Service Connections	LF	2,727

B. Gravity Sewer Design

The backbone gravity sewer system will be constructed of 8-inch and 10- inch PVC pipe at a minimum depth of 6 feet (unless otherwise approved by the District) and a minimum slope of 0.0033 ft/ft and 0.0024 ft/ft respectively. Manholes will be spaced at a maximum distance of 500 feet and will provide a 0.1' invert drop for direction changes less than 45 degrees, otherwise a 0.2' invert drop will be utilized when direction changes are greater than or equal to 45 degrees. The gravity sewers will be sufficient to carry peak flows generated in the collection system and will also be adequate to handle the projected future wastewater flows in the southern planning area.

The slope, size of pipe, velocity and depth of flow in each pipe segment has been calculated based upon a peak flow. However, some areas along the backbone gravity sewer line have been upsized by one pipe size diameter (from 8-inch to 10-inch) to provide for future development of State Land parcels adjacent to the backbone gravity sewer system and further to flatten the slope mitigating potential groundwater impacts. This information is included in Table 8 (see Appendix 4) for the backbone sewer system, pursuant to ADEQ engineering review requirements. Appendix 8 also contains the gravity sewer system worksheet for each of the three communities addressed in the design report. In addition, each building sewer connection includes an Elder Valve Disconnect per District standards.

The community gravity sewer systems will be constructed mainly of 8-inch PVC sewer pipe in accordance with ADEQ requirements. The design of 6-inch diameter sewers will adhere to AAC R18-9-E301. 401(D)2(d).

As previously mentioned, the District has attempted to design the gravity sewer mains at a sufficient depth to serve the adjacent properties along the backbone alignment on SR95A. However, due to topography and unknown site conditions, some locations may not be practical to be served by gravity. In those instances, the property owner will be required to convey their wastewater flow to the building sewer connection or sewer lateral stubbed at the property line. Generally, a grinder type pump station will be used in these instances.

C. Force Main Design

The force mains originating at each lift station have been sized according to the criteria discussed in Section 3.3. The force main located at wash crossings include design at a minimum of five feet under the 100-year scour depth. The force main shall be epoxy lined ductile iron pipe with polywrap. The proposed construction material for the remaining force main is Polyvinyl Chloride (PVC) sewer pipe.

Air release valves have been placed at high points in the force main alignments. The proposed design includes two air release valves at high points in the SR95A 4-inch diameter force main alignment, one air release valve for the proposed 6-inch force main from Lift Station No. 2, and two air release valves for the proposed 6-inch force main from Lift Station No. 3. Table 9, below, lists force main operational data for each lift station.

Table 9. Force Main Data

Lift Station	Force Main Diameter	Velocity	Material
LS No. 1	4-inch	3.12 fps	PVC
LS No. 2	6-inch	3.41 fps	PVC
LS No. 3	6-inch	3.86 fps	PVC

D. Lift Station Design

As discussed, there will be three lift stations constructed in the backbone system. Each lift station will be a submersible pumping station equipped with two identical pumps. The lift stations have been sized to handle all existing flows at peak conditions. In most cases, the selected pumps will be capable of handling future flows as well. Individual pumping units shall have the capacity such that, with any unit out of service, the remaining unit will have the capacity to handle the design peak hourly flow. See Appendix 5 for a summary of the design calculations of each lift station and force main component.

1. Civil-Mechanical Design

Each lift station is equipped with a round pre-cast concrete wet well with locking hatch. All wet wells will be coated inside and out with corrosion protection measures to ensure a minimum 20-year design life. Also, each lift station includes dual submersible pumps, capable of independent operation, each with dedicated discharge pipes and valving. A check valve is incorporated on each discharge pipe to prevent backflow. Lift Station No.'s 2 & 3 will be enclosed by an eight foot tall concrete block wall. A 12-foot wide gate shall be provided for access into the facility. Lift Station No. 1 already has an existing concrete block wall and fence surrounding the site.

2. Structural Design

Each lift station wet well includes specifications as to material, depth and inside dimension. The contractor is required to submit shop drawings sealed by a registered Professional Engineer showing their design is capable of withstanding all loads associated with buried installations, buoyancy requirements, and satisfy all applicable building codes. In addition, the valve vaults shall be subject to the same requirements.

Soil borings have been conducted at each wet well location and the results provided for the wet well designer's use in determining loads, floatation potentials and soil bearing capacities.

3. Electrical Design

Each lift station includes a service entrance section (SES), automatic transfer switch (ATS), Motor Control Center (MCC), alarm, auto dialer and standby generator. The auto dialer included for each lift station is configured to contact a District-specified 24-hour monitored location.

Each lift station in this design phase will be equipped with an automatic transfer switch and a diesel powered generator capable of operating two pumps and all of the ancillary equipment on site. Appropriate fuel capacity will be provided for 24-hour operation.

4. Forced-Air Odor Control Systems

The District has indicated they prefer dry adsorption scrubbers with replaceable media contained in sacks or bags. The fans will be configured to pull the air out of the wet well and through the media container in order to eliminate the need for explosion-proof fan motors.

The finished grade of each lift station is at least one foot above the established 100-year flood elevation. All above-ground equipment at the stations shall be further raised above the finished grade on concrete slabs.

E. Lift Station Summaries

1. Lift Station No. 1 (Rio Lindo Area)

Lift Station No. 1, located at Rio Lindo, will be sized to handle all existing and future flows generated by Sundance Resort, Rio Lindo, Fox's RV Park, and Sandbar Resort at Red Rock. This lift station will discharge into a 4 inch diameter PVC force main and will convey wastewater in a southerly direction to a manhole (MH#25) on the north side of Marina Village North. See below for Lift Station No. 1 design parameters.

Lift Station No. 1	
Description	Design Parameters
Design Avg. Flow (gpm)	18
Design Peak Flow (gpm)	60
Diameter of Wet Well (ft)	6
Wet Well Capacity (gal)	423
Size of force main (in)	4
Length of force main (ft)	4,600
Pumping Rate (gpm)	130

Note: In accordance with R18-9-E301 D (1) b(ii) , the calculated peak dry weather flow for Lift Station No. 1 is 126 gpm based on a population of 322. The pumping rate of 130 gpm exceeds the minimum peak dry weather flow required by ADEQ. Actual water usage rates recorded by Brooke Water Utility serving Rio Lindo and Fox's show that the highest average daily flow rate over the past 9 months is 5,720 gpd (September, 2012). This is far below the design flow rates for wastewater. The wastewater flow projected from these two communities is estimated at only 13,606 gpd including the restaurant

flow. See Appendix 5 for a graph of the system head curve plotted against the recommended pump curve for Lift Station No. 1.

2. Lift Station No. 2 (Marina Village Area)

Lift Station No. 2, located at the north end of La Paz County Park, will be sized to handle all existing and future flows from Marina Village North, Marina Village, Marina Village Annex, and Road Runner RV Park, as well as upstream flows conveyed by Lift Station No. 1 at Rio Lindo. Lift Station No. 2 will discharge into a 6 inch diameter PVC force main and will convey wastewater in a southerly direction to a manhole (MH#11) on the south side of La Paz County Park. See below for Lift Station No. 2 design parameters.

Lift Station No. 2	
Description	Design Parameters
Design Avg. Flow (gpm)	51
Design Peak Flow (gpm)	160
Diameter of Wet Well (ft)	8
Wet Well Capacity (gal)	752
Size of force main (in)	6
Length of force main (ft)	5,126
Pumping Rate (gpm)	294

Note: In accordance with R18-9-E301 D(1) b(ii) , the calculated peak dry weather flow for Lift Station No. 2 is 196 gpm based on a population of 917. The pumping rate of 294 gpm is far in excess of the minimum peak dry weather flow required by ADEQ. See Appendix 5 for a graph of the system head curve plotted against the recommended pump curve for Lift Station No. 2.

3. Lift Station No. 3 (Branson Area)

Lift Station No. 3, located on Buckskin Sanitary District leased land near Branson Resort will be sized to handle all existing and future flows from the Branson Resort Area, the La Paz County Recreational Area, and all upstream flows conveyed by Lift Station No. 2 at the north end of La Paz County Park. This lift station will discharge into a 6 inch diameter PVC force main and will convey wastewater in a southerly direction to the influent manhole of the Buckskin Sanitary District WWTP. See below for Lift Station No. 3 design parameters.

Lift Station No. 3	
Description	Design Parameters
Avg. Design Flow (gpm)	90
Peak Design Flow (gpm)	270
Diameter of Wet Well (ft)	8
Wet Well Capacity (gal)	752
Size of force main	6
Length of force main	8,045
Pumping Rate (gpm)	341

Lift Station No. 3 serves more than 600 dwelling units and is therefore not subject to the requirements of R18-9-E301 D(1) b(ii). See Appendix 5 for a graph of the system head curve plotted against the recommended pump curve for Lift Station No. 3.

VI. PROJECT COST ESTIMATE

See Appendix 6 for a preliminary construction cost estimate of the Phase 4 Wastewater Conveyance System including all community gravity sewer systems.