



HENDERSON™

City of Henderson, Nevada

Technical Memorandum
West Henderson Water Infrastructure
Phasing Strategy 2022 Update

FINAL | August 2022





City of Henderson, Nevada

Technical Memorandum
WEST HENDERSON WATER INFRASTRUCTURE
PHASING STRATEGY 2022 UPDATE

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Abbreviations

\$/EDU	Cost per EDU
AACE	Association for the Advancement of Cost Engineering
BLM	Bureau of Land Management
Carollo	Carollo Engineers, Inc.
CCI	Construction Cost Index
City	City of Henderson, Nevada
COH	City of Henderson
EDU	Equivalent Dwelling Unit
ENR	Engineering News Record
ft	foot / feet
ft/s	feet per second
gpm	gallons per minute
HL	Horizon Lateral
HMC	Henderson Municipal Code
MDD	Maximum Day Demand
MG	million gallons
mgd	million gallons per day
mi	miles
NAC	Nevada Administrative Code
PHD	Peak Hour Demand
PS	Pump Station
psi	pounds per square inch
R & PP	Recreation and Public Purpose
ROFCS	Rate of Flow Control Station
SNWA	Southern Nevada Water Authority
TM	Technical Memorandum

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Section 1

PROJECT BACKGROUND

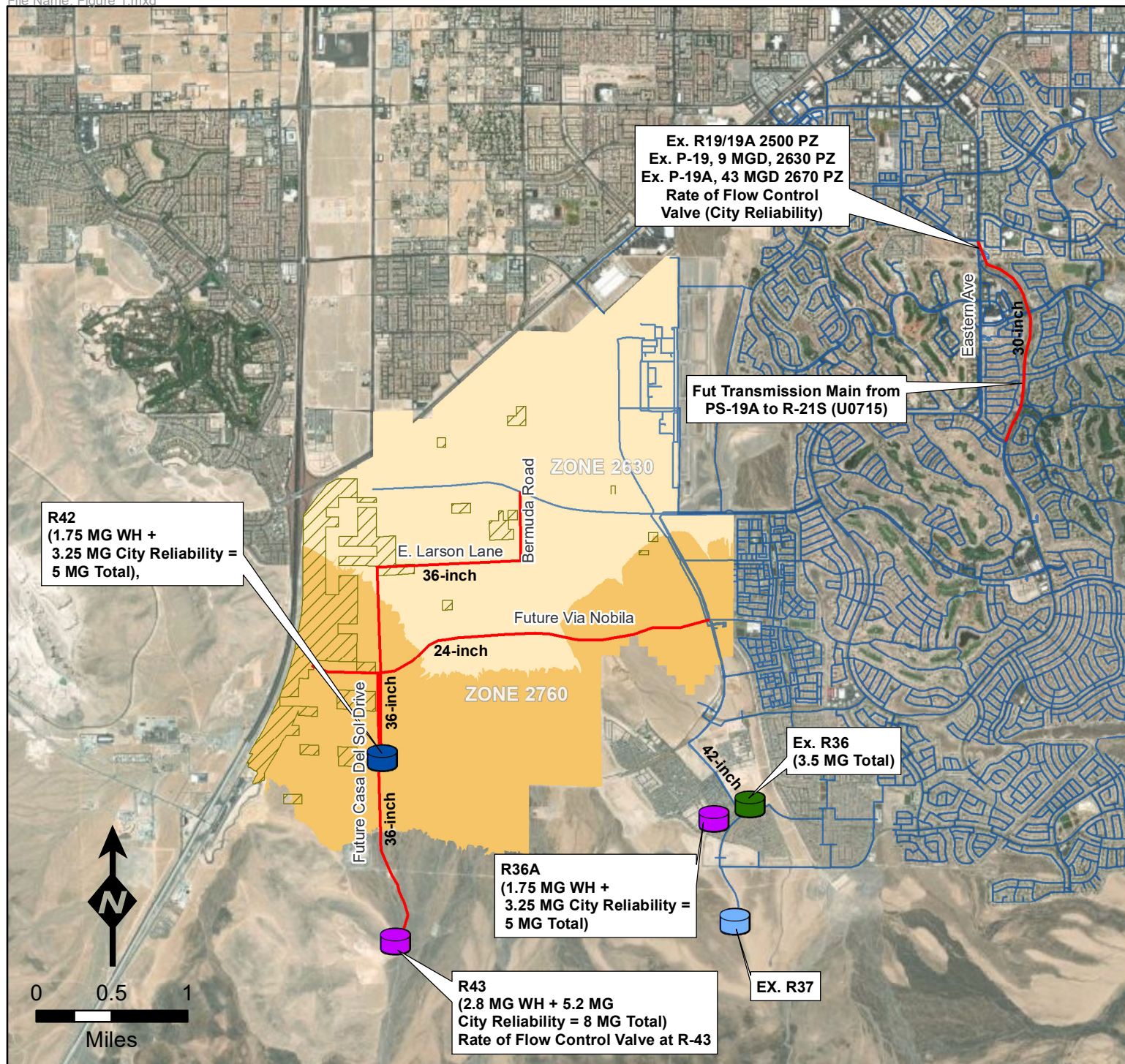
The purpose of this Technical Memorandum (TM) is to provide the engineering basis for determining the project cost and the cost for each Equivalent Dwelling Unit (EDU) for the infrastructure associated with the City of Henderson, Nevada (City) West Henderson 2630 and 2760 Pressure Zone Water Infrastructure Improvements. This TM serves to update the planning study previously documented in *West Henderson Water Infrastructure Phasing Strategy Update*, prepared by Carollo Engineers, Inc. (Carollo) (2016). This planning-level study evaluated the required backbone water infrastructure for buildout development in the West Henderson planning area and included preliminary technical analysis and infrastructure cost opinions used to establish the cost per EDU for Phase 1 and Phase 2 for the West Henderson 2630 and 2760 pressure zones.

The City is currently updating the planning-level cost estimates included in the 2016 study due to the following:

- Changes in the planned operational strategy and infrastructure requirements due to the acceleration of the Southern Nevada Water Authority (SNWA) Horizon Lateral (HL). The City has revised the backbone water infrastructure planning for West Henderson in response to the approval of the SNWA Board of Directors of the 2020 Amended Major Construction and Capital Plan that included the addition of the Horizon Lateral project that, once completed, will ensure future reliability and provide additional water system capacity for the West Henderson 2630/2760 Pressure Zones.
- Escalation in project construction costs.
- Escalation in the rate of inflation, and its impact on the projected financing charges.
- Adjustment in infrastructure capacities due to the reassessment of the water demand/EDU projections.
- Changes in the assessment rate due to a substantially lower assessment rate of approximately 1.42 EDUs per acre for developed properties, compared to the original assessment rate projection of 7.25 EDUs per acre.
- Elimination of project phasing.

The updated cost estimates will allow the City to establish an updated Meter Equivalency Chart and revised Charge rates for the West Henderson Backbone Infrastructure.

The scope of this technical memorandum covers water service and associated infrastructure for the 2630 and 2760 pressure zones. It does not consider water service or infrastructure requirements for the remainder of West Henderson that lies within the corporate boundaries of the City but extends outside of these pressure zones. See Figure 1 for details of the study area boundaries.



HENDERSON

Legend

Reservoir

- Existing (PZ 2870)
- Existing (PZ 2760)
- PZ 2630
- PZ 2760

Water Pipe

- Existing Pipeline
- Installed by City
- Unincorporated Clark County

Study Area

- Pressure Zone 2630
- Pressure Zone 2760

WATER SYSTEM INFRASTRUCTURE FIGURE 1

WEST HENDERSON WATER
INFRASTRUCTURE PHASING
STRATEGY UPDATE
2022



It is recognized that development may occur to some degree in each pressure zone throughout the planning period. Therefore, this TM allocates infrastructure costs by pressure zone. This provides the City with flexibility to adjust the infrastructure plan based on actual growth patterns. If adjustments are necessary, this technical memorandum will be amended accordingly.

In the 2016 *West Henderson Water Infrastructure Strategy Update*, costs per EDU (\$/EDU) were established for each of the 2630 and 2760 pressure zones based on the proportionate share of the construction cost of the water infrastructure improvements required for that pressure zone. The following engineering information necessary to determine the construction cost and cost per EDU was determined in the 2016 study:

- Potable water service area demands.
- Integration of new backbone infrastructure with existing infrastructure.
- Routing of pipelines through anticipated traffic corridors.
- Pipeline sizes.
- Reservoir storage volumes.
- Pump station capacities.
- Land acquisition requirements.

The City has since made updates to these parameters that impact the costs per EDU; these updates are described in Section 5.

Section 2

LOCATION

The West Henderson Water Infrastructure Strategy Update Project is located at the southwest City boundary as presented on Figure 1 and described in Appendix A. The West Henderson 2630 and 2760 pressure zones encompass an area of approximately 4,850 acres within incorporated City limits and unincorporated Clark County areas within the service area. Approximately 700 acres located within the service area are unincorporated Clark County areas. It is anticipated that the unincorporated Clark County areas may be annexed into the City in the future, or may obtain water service from the City; therefore, the unincorporated Clark County areas are included in the water demand analysis and accounted for in the revised Charge rates per EDU for the West Henderson service area.

Section 3

PRESSURE ZONES

There are two pressure zones located in the West Henderson service area: Pressure Zone 2630 and Pressure Zone 2760. At final buildout, 20 million gallons per day (mgd) of water supply is modeled to originate from the SNWA Horizon Lateral. The Parkway Rate of Flow Control Station (ROFCS) will supply the area until the anticipated Horizon Lateral is operational in approximately 2030.

Section 4

MODELING CRITERIA

Hydraulic modeling of the West Henderson infrastructure was completed as part of the 2016 *West Henderson Water Infrastructure Phasing Strategy Update*. Modeling was based on the design and evaluation criteria provided in Table 1. Based on the updated hydraulic modeling completed by the City, all system performance criteria for pressure and flow meet the City's requirements and 2020 City of Henderson Potable Water System Master Plan Update. Pipe velocity criteria are generally met with the proposed backbone infrastructure. In some cases, minor exceedances were allowed to pipe velocity criteria where maximum headloss criteria were met.

Table 1 System Design and Evaluation Criteria

Criteria	Description	Value	Units
Pressure	Minimum Pressure	Positive pressure must be provided at all nodes	-
Maximum Day Demand (MDD)	Minimum Pressure	40	psi
	Maximum Velocity	6	ft/s
Peak Hour Demand (PHD)	Minimum Pressure	30	psi
	Maximum Velocity	8	ft/s
	Head Loss		
	Pipe diameter < 16-inch	10	ft/1,000 ft
	Pipe diameter ≥ 16-inch	3	
MDD plus Fire Flow	Residential – Single family	1,500/2	gpm/hours
	Residential – Multi-family	2,500/2	gpm/hours
	Commercial	3,000/3	gpm/hours
	Industrial	3,500/4	gpm/hours
	Institutional	3,500/4	gpm/hours
	Point Fire Flows	Site specific	gpm/hours
	Minimum Pressure	20	psi
	Maximum Velocity	20	ft/s
Pumping Criteria	Firm Capacity	Equal to MDD	mgd
	Equipment	Minimum of 3 pumps	N/A
Storage Criteria	Operational	Difference between PHD and MDD for 6 hours	MG
	Fire Flow	Operational plus highest fire flow required in the zone for required duration	MG
	MDD	Maximum Day Demand	MG
	Total	Two times operational OR Operational plus fire storage OR One day times maximum day demand, whichever is greater	MG
	Tank Level	Minimum allowable reservoir water level is set based on the low-level operating conditions for each reservoir	-
		Reservoirs must return to at least 10 ft from top of the tank by the end of the maximum day	
ROFC	Flow Capacity	The total flows should not exceed the maximum capacity at each ROFC location	-

Abbreviations:

MDD = Maximum Day Demand; PHD - Peak Hour Demand; psi = Pounds per square inch; ft = foot / feet; MG = million gallons; gpm = gallons per minute; mgd = million gallons per day.

Section 5

CHANGES TO APPROACH FOR INFRASTRUCTURE REQUIREMENTS AND IMPLEMENTATION

Changes to the approach for identifying and implementing infrastructure requirements are discussed in the following sections.

5.1 Phasing

Previously, there were two infrastructure planning phases established for development in West Henderson:

- Phase 1 - Year 2025 - 2033.
- Phase 2 - Year 2033 - 2043.

These planning phases were defined using annual water demand projections developed for West Henderson from 2016 through year 2043. The first phase assumed a maximum of 20 mgd would be provided through the Bermuda ROFCS. The second phase represented buildout conditions and included additional infrastructure needed to meet projected buildout demands, where additional supplies would come from the SNWA Horizon Ridge ROFCS.

However, the City's updated operational approach assumes the Horizon Ridge ROFCS and Parkway ROFCS will supply the area until the Horizon Lateral is operational in approximately 2030. Upon completion of the SNWA Horizon Lateral, water will be supplied north from ROFCS 36 and 43. This eliminates the need for a phased infrastructure planning approach.

5.2 Potable Water Demand

The City has recently updated the potable water demand projections by adjusting the EDU projections based on the current EDU assessment rate, actual water usage of developments in the West Henderson 2630/2760 Pressure Zones, and current development trends. These updates are discussed in the following sections, and EDU projections by land use are provided in Appendix B.

5.2.1 Updates to EDU Projections

Since the 2016 *West Henderson Water Infrastructure Phasing Strategy Update* was issued, approximately 20 percent of the developable land within the 2630/2760 Pressure Zones has been developed or is under development. The EDU assessment rate for the developed properties average 1.42 EDUs per acre, which is substantially lower than the original projection of 7.25 EDUs per acre that was utilized as the basis for establishing the West Henderson Phase I Water Backbone Infrastructure Rates in 2017 (HMC 14.18.045). This significant underassessment in EDUs prompted the City to relook at the original approach established with the 2016 study.

Based on actual water usage of developments within the West Henderson 2630/2760 Pressure Zones, the City determined the EDU calculations needed to be applied to the Commercial and Industrial Meter Equivalency Chart in a manner consistent with how the EDU calculation factors are applied in the Southern Nevada Water Authority (SNWA) Regional Connection Charge. In doing so, the EDU assessment rate would be more consistent with the water use patterns from existing projects. The total number of EDUs calculated for the 2630/2760 Pressure Zones using this method is estimated to be 14,771. Refer to Appendix B, Table B.5 for a comparison of previous and current EDU projections.

5.2.2 Updates to Projected Water Demands

The City updated the water demand projections based on the current development trends within the West Henderson 2630/2760 Pressure Zones. Analysis of annual water usage highlighted lower water usage of single-family residential properties due to achievements in water conservation. The proposed ordinance will revise the definition of an equivalent dwelling unit (EDU) from "a measure of water demand equivalent to the amount of water generated per annually by an average single-family residential dwelling unit ... equivalent to 0.75 acre-feet of water per year" to 0.55 acre-feet of water per year. A discrepancy in projected water demand and actual water usage was also observed in the non-residential developments. The City has determined the EDU calculation factors of the SNWA Regional Connection Charge table more accurately represent the water usage trends observed among the recently developed non-residential properties. The SNWA Regional Connection Charge is set out in HMC 14.18.050.

In addition, on November 19, 2020, the SNWA Board of Directors approved the 2020 Amended Major Construction and Capital Plan that included the addition of the Horizon Lateral project that, once completed, will help ensure future reliability of the Southern Nevada Water System and provide additional water system capacity for the West Henderson 2630/2760 Pressure Zones.

The MDD and PHD for all land areas to be served by the West Henderson Water Backbone Infrastructure are presented in Table 2 by pressure zone.

Table 2 Potable Water MDD and PHD: Zone 2630 and Zone 2760

Maximum Day Demand (mgd)			Peak Hour Demand (mgd)		
PZ 2630	PZ 2760	Total	PZ 2630	PZ 2760	Total
10.7	9.3	20	18.2	15.8	34

5.3 Supply Sources

Currently, water is supplied to West Henderson from SNWA's South Valley Lateral through the Horizon Ridge ROFC and Parkway ROFC to Pump Station 19A, which pumps to R-36 to serve the 2760 PZ and PRV-88 to serve the 2630 PZ. R-36A is currently under construction to serve West Henderson and restore full availability of R-36 to serve the Inspirada Development. Completion of the SNWA Horizon Lateral is anticipated by 2030. To date, it is not known whether the proposed Northern or Southern Alignment will be constructed. Upon completion of the SNWA Horizon Lateral, water will be supplied from ROFCS 36 to R-36/36A to serve the 2760 PZ and ROFCS 43 to R-43 and subsequently R-42 to serve the 2630 PZ. PRV-88 may remain in place for emergencies or to provide operational flexibility. If the Horizon Lateral is out of

service, water will be supplied from the South Valley Lateral via Horizon Ridge ROFCS and Parkway ROFCS. Water supply sources for West Henderson are summarized in Table 3.

Table 3 West Henderson Supply Sources

Phase	Year	Maximum Water Supply (mgd)			
		Horizon Ridge ROFCS	Parkway ROFCS	ROFCS 36 ⁽¹⁾	ROFCS 43
Current	2022-2030	73	43	0	0
Buildout, Horizon Lateral Northern Alignment	2030-2043	-	-	30	30
Buildout, Horizon Lateral Southern Alignment	2030-2043	-	-	90	30

Notes:

(1) May provide some support to Zone 2760 while capacity is available from the Inspirada Development to leverage existing infrastructure.

5.4 Pipelines

The *West Henderson Water Infrastructure Phasing Strategy Update* (2016) included a system-wide assessment and an overall plan to achieve a complete water system and included transmission pipelines that convey water between pump stations and reservoirs within the Phase 1 and 2 backbone water infrastructure. Some of these pipelines are no longer required; the remaining required pipelines are shown in Figure 1.

Table 4 compares the previous and current pipeline requirements by pipeline diameter and length.

Table 4 Pipeline Diameter and Length Comparison

Diameter (inch)	Pipeline Length (ft)	
	2016 Water infrastructure Phasing Strategy Update (Phase 1 & Phase 2)	Current Operational Approach
12	13,157	0
16	39,798	0
20	1,366	0
24	53,717	17,500
24/36	0	17,820
30	5,474	7,420
36	1,656	6,000
42	0	0
Total	115,168	48,740
Total (mi)	22	9.2

Abbreviation:

mi = miles

5.5 Pump Stations

Pump stations that were included in the 2016 study but are no longer required for the City's updated operational approach include:

- COH Bermuda Pump Station.
- COH Pump Station P-35.
- COH Pump Station P-35A.
- COH Pump Station P-42.
- COH Pump Station P-42A.
- COH Horizon Ridge Pump Station (also referred to as P-18A).

There are no new pump stations in the current water infrastructure plan. However, costs related to the preliminary design of two pump stations are included in the overall infrastructure cost estimate.

5.6 Reservoirs

The reservoir requirements in the *West Henderson Water Infrastructure Phasing Strategy Update* (2016) were modeled to ensure compliance with all aspects of storage capacity as required by the Nevada Administrative Code (NAC) and to increase overall water system reliability. All reservoirs were modeled as below-grade, cast-in-place concrete reservoirs, with the exception of R-36A, which was modeled as an above-grade reservoir to match an existing above-grade reservoir at R-36.

Table 5 shows a comparison of the reservoir requirements modeled in the 2016 Water Infrastructure Phasing Strategy and the current operational strategy. All reservoirs under the current operational strategy are assumed to be pre-stressed, above-ground concrete reservoirs with cast-in-place core.

Table 5 Reservoir Sizing and Volume Update

Reservoir Sites	Volume (MG)	
	2016 Water infrastructure Phasing Strategy Update (Phase 1 & Phase 2)	Current Operational Approach
Zone 2630		
R-35	5	-
R-35A	5	-
R-42	5	5
R-42A	5	-
Total Reservoir Volume: Zone 2630	20	5
Zone 2760		
R-36A	5	5
R-36B	5	-
R-43	5	4
R-43A	5	4
Total Reservoir Volume: Zone 2760	20	13

5.7 Land Acquisition

All reservoirs are proposed to be located on Bureau of Land Management (BLM) owned land. The City is in the process of preparing grant applications to submit to BLM, for issuance of Recreation and Public Purpose (R & PP) leases to secure these sites for future use by the City. Therefore, all land acquisition costs incorporated into the Engineers Opinion of Probable Project Cost are intended to cover costs associated with securing necessary rights-of-way for the pipeline corridors.

Section 6

CONCEPTUAL COST OPINIONS

The conceptual cost opinion is shown by infrastructure need in Table 6 and summarized in Table 7. The conceptual cost opinion for Reservoir R-43, R-43A, the associated 36-inch transmission main, and the new ROFCS at Site R-42 is presented in *West Henderson Water Infrastructure Cost Estimate Update: R-43, R-43A, and 36-inch Transmission Main* (Carollo, July 2022), included in Appendix C. The conceptual cost opinion for the new 30-inch transmission main between PS19A and R-21S and associated ROFCS is presented in *Draft Future Transmission Main (U0715-TM and U0715-FCS) Alignment Study and Planning Level Cost Estimate* (Carollo, August 2022). All other costs presented were provided by the City.

The cost opinions are expressed in July 2022 dollars (corresponding 20 Cities Average Engineering News Record (ENR) Construction Cost Index (CCI) = 13,168). The cost opinion is consistent with Class 5 Estimates as defined by the Association for the Advancement of Cost Engineering (AACE) International. This level of engineering cost estimating is generally made with limited information, including proposed facility type, location, and capacity. Typical accuracy for Class 5 Estimates is expected to be in the range of -50 to +100 percent. This level of accuracy is appropriate for preliminary budget level estimating.

Table 6 Engineer's Opinion of Probable Project Cost

Backbone Infrastructure Required	Size	Cost	EDUs Served
1. COH Bermuda PS Design ⁽¹⁾	N/A	\$127,809	14,771
2. COH 40 mgd PS Design ⁽²⁾	N/A	\$450,000	14,771
3. Pipeline (2630 PZ Transmission Main to/from R-42) ⁽¹⁾	24/36 in	\$29,263,592	14,771
4. Pipeline (Via Nobila 2630 PZ + 2760 PZ) ⁽¹⁾	24 in	\$10,684,099	14,771
5. Reservoir R-42 ⁽³⁾	5 MG	\$19,064,000	14,771
6. ROFC at R-42 ⁽¹⁾	25 mgd	\$1,890,000	14,771
7. Miscellaneous Improvements at Site 36 for HL ⁽¹⁾	N/A	\$1,000,000	14,771
8. Pipeline (Horizon Ridge PS to R-35) ⁽²⁾	42 in	\$250,000	14,771
9. Pipeline (PS19A to R-21S) and ROFC ⁽²⁾	30 in	\$12,640,000	14,771
10. Reservoir R-43 ⁽³⁾	4 MG	\$15,890,000	14,771
11. Reservoir 43A ⁽³⁾	4 MG	\$12,840,000	14,771
12. Reservoir R-36A ⁽³⁾	5 MG	\$8,500,000	14,771
13. Pipeline (R-43 to R-42) ⁽¹⁾	36 in	\$5,200,000	14,771
Total Project Cost		\$117,799,500	

Notes:

(1) This cost is 100 percent developer-funded.

(2) This cost is 100 percent City-funded for City water system reliability.

(3) The costs for Reservoirs R-42, R-36A, R-43, and R43-A are split to reflect a 35 percent benefit to West Henderson EDUs, and 65 percent benefit for City's water system reliability.

Abbreviations:

COH = City of Henderson; PS = Pump Station

Escalated project costs were provided by the City and are based on a cash flow analysis for 2021 through 2040, with inflation indices ranging from 1.5 to 7.5 percent. See Table 7 and Appendix D for details.

Table 7 Engineer's Opinion of Probable Project Cost – West Henderson 2630 and 2760 Pressure Zones

	2016 Water infrastructure Phasing Strategy Update (Phase 1 & Phase 2)	Current Operational Approach
City Contribution (\$M)	\$80.8	\$49.9
Developer Contribution (\$M)	\$115.0	\$67.9
Total Estimated Project Cost (\$M)	\$195.8 ⁽¹⁾	\$117.8 ⁽²⁾
Total Estimated Project Cost – Escalated (\$M) ⁽³⁾	\$100.0 ⁽³⁾	\$138.6 ⁽⁴⁾

Notes:

(1) Total estimated project costs reflect 2016 market conditions and thus do not account for inflation or the projected market conditions at the time the projects are projected to be constructed.

(2) Total estimated project costs reflect 2022 market conditions and thus do not account for inflation or the projected market conditions at the time the projects are projected to be constructed.

(3) Applies to Phase 1 only. The cash flow associated with the construction activity was analyzed with a 1.5 percent cost escalation per year through 2033, when it was anticipated that the Phase 1 water backbone infrastructure would be fully constructed.

(4) Based on analysis completed by City; see details in Appendix D.

Section 7

COST PER EQUIVALENT DWELLING UNIT (EDU)

Due to escalation in both construction costs and inflation, and actual water demands that are lower than previously projected, the costs per equivalent dwelling unit (\$/EDU) developed in the 2016 study are not high enough to cover the infrastructure costs and would result in a budget shortfall of approximately \$45 million at buildout. The City considered multiple options to address this shortfall while maintaining consistency with the established rates for each pressure zone.

To develop updated costs per EDU, the City estimated the total cost of West Henderson water infrastructure improvements using the updated construction cost opinions, including construction inflation and financing costs. The costs per EDU developed in the 2016 study for the 2630 and 2760 pressure zones were then updated based on the updated EDU projections and rate increases that consider the changes to the new infrastructure required for each pressure zone. Based on these updates, the City is proposing new rates effective January 1, 2023, of \$3,527/EDU for 2630 Pressure Zone and \$5,660/EDU for 2760 Pressure Zone.

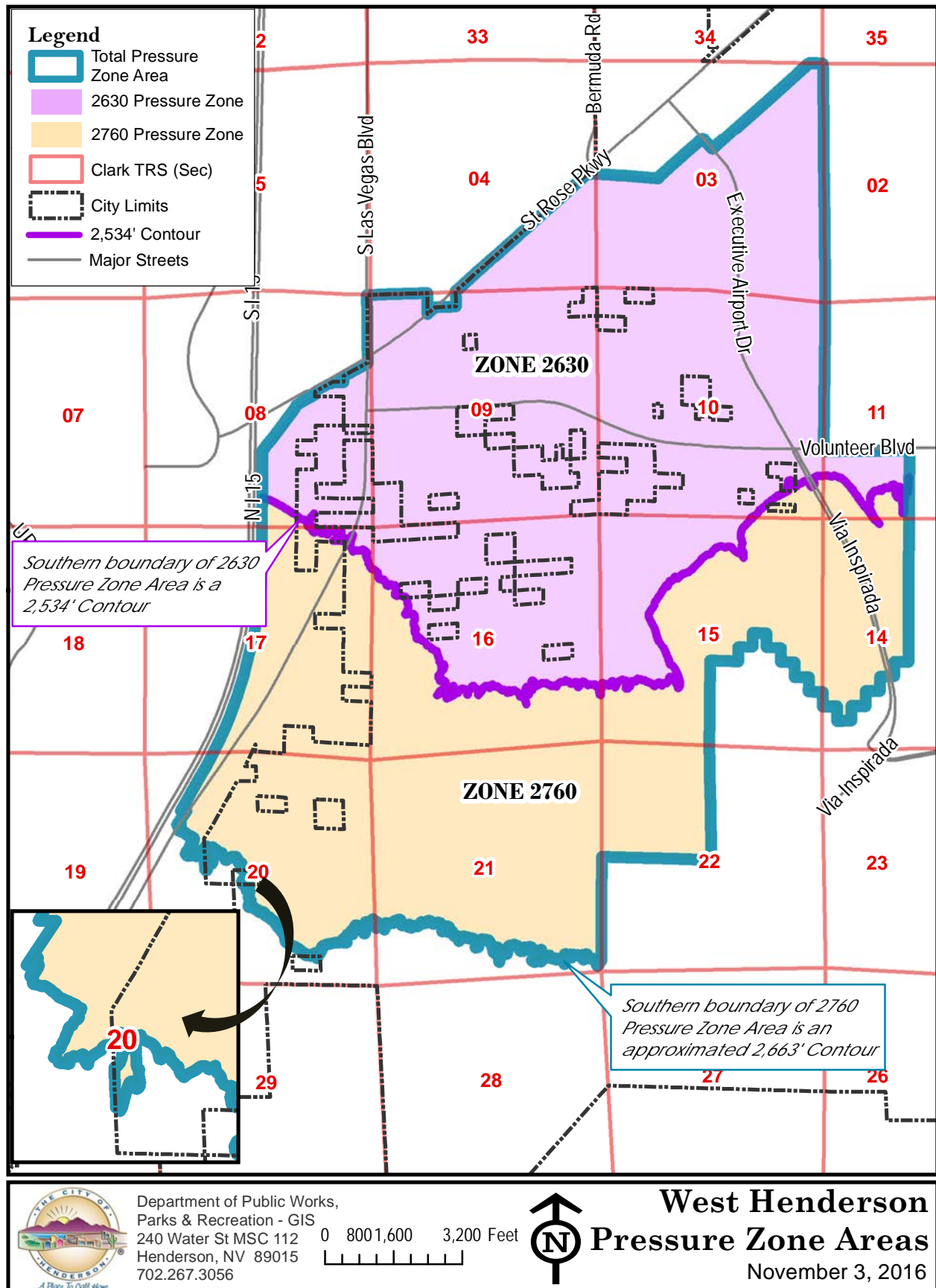
Section 8

FINANCING STRATEGY

The proposed new rates of \$3,527/EDU for 2630 Pressure Zone and \$5,660/EDU for 2760 Pressure Zone include an updated financing strategy to account for anticipated development rates in each zone. The City Manager may adjust the rates once each calendar year by up to 15 percent for the 2630 Pressure Zone and up to 10 percent for the 2760 Pressure Zone. The City's financing strategy assumes financing charges of 4 percent to account for impacts from actual bond issuances. Progress will be reassessed annually, and further refinement of rates will occur in five years, or when deemed necessary.

Appendix A

STUDY AREA LEGAL DESCRIPTION



WEST HENDERSON PRESSURE ZONE AREAS

The following describes the 2630 and 2760 Pressure Zones in the West Henderson area located in Sections 3, 4, 8, 9, 10, 11, 14, 15, 16, 17, 20, 21, and 22, Township 23 South, Range 61 East, M.D.M., Clark County, Nevada, described as follows:

The South Half (S 1/2) of Section 3.

TOGETHER WITH: That portion of the North Half (N 1/2) of Section 3, lying southeast of the northwesterly line of Lot 1 of the Henderson Quail Air Center in Book 141, Page 79 of Plats, Clark County, Nevada and the prolongation of said line to the northeasterly line of Lot 1 of the Sage Mountain Commerce Center in Book 111, Page 6 of Plats, Clark County, Nevada and south of the northeasterly and northwesterly lines of said Lot 1 of the Sage Mountain Commerce Center.

TOGETHER WITH: All of the South Half (S 1/2) of Section 4, lying southeast of State Highway 146, also known as the St. Rose Parkway.

TOGETHER WITH: All of Section 8, lying southeast of State Highway 146, also known as the St. Rose Parkway, and east of the easterly right-of-way of I-15.

TOGETHER WITH: All of Section 9, excepting that portion of the Northeast Quarter (NE 1/4) of the Northwest Quarter (NW 1/4) lying northwest of State Highway 146, also known as the St. Rose Parkway.

TOGETHER WITH: All of Section 10.

Together with: The South Half (S 1/2) of the Southwest Quarter (SW 1/4) of the Northeast Quarter (NE 1/4) of the Southwest Quarter (SW 1/4); the West Half (W 1/2) of the Southeast Quarter (SE 1/4) of the Southwest Quarter (SW 1/4); the Southwest Quarter (SW 1/4) of the Southwest Quarter (SW 1/4) and the South Half (S 1/2) of the South Half (S 1/2) of the Northwest Quarter (NW 1/4) of the Southwest Quarter (SW 1/4) of Section 11.

TOGETHER WITH: The Northwest Quarter (NW 1/4) of the Northeast Quarter (NE 1/4) of the Southwest Quarter (SW 1/4); the Northwest Quarter (NW 1/4) of the Southwest Quarter (SW 1/4) of the Northeast Quarter (NE 1/4) of the Southwest Quarter (SW 1/4); the Northwest Quarter (NW 1/4) of the Northeast Quarter (NE 1/4) of the Southwest Quarter (SW 1/4) of the Southwest Quarter (SW 1/4); the North Half (N 1/2) of the Northwest Quarter (NW 1/4) of the Southwest Quarter (SW 1/4) of the Southwest Quarter (SW 1/4); the Northwest Quarter (NW 1/4) of the Southwest Quarter (SW 1/4); the Southeast Quarter (SE 1/4) of the Northwest Quarter (NW 1/4) of the Southwest Quarter (SW 1/4) of the Southwest Quarter (SW 1/4); the West Half (W 1/2) of the East Half (E 1/2) of the Northwest Quarter (NW 1/4) and the West Half (W 1/2) of the Northwest Quarter (NW 1/4) of Section 14.

TOGETHER WITH: The North Half (N 1/2); the Northeast Quarter (NE 1/4) of the Northeast Quarter (NE 1/4) of the Southeast Quarter (SE 1/4); the North Half (N 1/2) of the Southeast

Quarter (SE 1/4) of the Northeast Quarter (NE 1/4) of the Southeast Quarter (SE 1/4); the Southeast Quarter (SE 1/4) of the Southeast Quarter (SE 1/4) of the Northeast Quarter (NE 1/4) of the Southeast Quarter (SE 1/4); the North Half (N 1/2) of the Northwest Quarter (NW 1/4) of the Northeast Quarter (NE 1/4) of the Southeast Quarter (SE 1/4); the Southeast Quarter (SE 1/4) of the Northwest Quarter (NW 1/4) of the Northeast Quarter (NE 1/4) of the Southeast Quarter (SE 1/4); the Northwest Quarter (NW 1/4) of the Northwest Quarter (NW 1/4) of the Southeast Quarter (SE 1/4); the Northwest Quarter (NW 1/4) of the Northeast Quarter (NE 1/4) of the Northwest Quarter (NW 1/4) of the Southeast Quarter (SE 1/4) and the Southwest Quarter (SW 1/4) of Section 15.

TOGETHER WITH: All of Section 16.

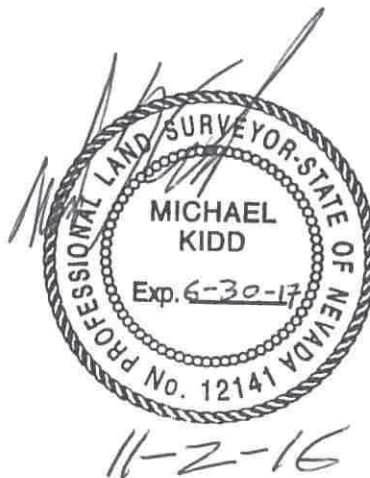
TOGETHER WITH: All of Section 17, lying east of the easterly right-of-way of I-15.

TOGETHER WITH: All of Section 20, lying north of the 2663-foot Contour line and east of the easterly right-of-way of I-15.

TOGETHER WITH: All of Section 21, lying north of the 2663-foot Contour line.

TOGETHER WITH: The Northwest Quarter (NW 1/4) of Section 22.

Containing 4847 Acres, more or less.



Appendix B

WEST HENDERSON PROJECTED LAND USE AND EDUS PER ZONE

West Henderson Projected Land Use and EDUs per Zone

- Table B.1 – 2630 Pressure Zone Land Use and Remaining Acreage to be Developed.
- Table B.2 – 2630 Pressure Zone EDUs.
- Table B.3 – 2760 Pressure Zone Land Use and Remaining Acreage to be Developed.
- Table B.4 – 2760 Pressure Zone EDUs.
- Table B.5 – West Henderson EDUs and \$ Projections (Current + Amended).
- Figure B.1 – West Henderson Water Backbone Infrastructure – EDU + \$ Projections (Current + Amended).

Table B.1 2630 Pressure Zone Land Use and Acreage

Land Use Type	Remaining Acreage to be Developed
Very Low Density Residential	0.00
Low-Density Residential	143.60
Medium-Density Residential	179.90
High-Density Residential	94.40
Business/Industry	45.70
Commercial	27.70
Employment Center	140.70
Neighborhood Center	24.80
Planned Community	0.00
Public/Semi-Public	376.30
Urban Center	214.60
Undefined	0.00
Clark County Las Vegas Blvd & Interstate 15	64.40
Total Acreage - All Land Uses	1,312

Table B.2 2630 Pressure Zone EDUs

Land Use Type	EDUs/ Acre	Equivalent Dwelling Units (EDUs)			
		EDUs Developed	EDUs CY2022	EDUs Remaining	Total
Very Low Density Residential	2.0	0	0	0	0
Low-Density Residential	5.0	343	100	718	1,161
Medium-Density Residential	9.7	73	97	1,749	1,919
High-Density Residential	12.2	173	0	1,155	1,329
Business/Industry	2.00	70	10	91	172
Commercial	2.80	34	0	78	111
Employment Center	2.35	254	47	331	632
Neighborhood Center	2.80	0	0	70	70
Planned Community	3.50	0	0	0	0
Public/Semi-Public	2.80	0	0	1,054	1,054
Urban Center	2.80	61	10	601	672
Undefined	3.00	0	0	0	0
Clark County Las Vegas Boulevard & Interstate 15	2.50	0	0	161	161
Total EDUs - All Land Uses		1,008	264	6,006	7,279

Table B.3 2760 Pressure Zone Land Use and Acreage

Land Use Type	Remaining Acreage to be Developed
Very Low Density Residential	4.90
Low-Density Residential	299.00
Medium-Density Residential	149.00
High-Density Residential	63.40
Business/Industry	163.10
Commercial	437.20
Employment Center	20.80
Neighborhood Center	19.40
Planned Community	0.00
Public/Semi-Public	434.70
Urban Center	24.50
Undefined	0.00
Clark County Las Vegas Blvd & Interstate 15	301.20
Total Acreage - All Land Uses	1,917

Table B.4 2760 Pressure Zone EDUs

Land Use Type	EDUs/ Acre	Equivalent Dwelling Units (EDUs)			
		EDUs Developed	EDUs CY2022	EDUs Remaining	Total
Very Low Density Residential	2.0	0	0	10	10
Low-Density Residential	5.0	0	0	1,495	1,495
Medium-Density Residential	9.7	0	0	1,448	1,448
High-Density Residential	12.2	0	0	776	776
Business/Industry	2.00	38	0	326	364
Commercial	2.80	0	15	1,224	1,239
Employment Center	2.35	4	14	49	67
Neighborhood Center	2.80	0	0	54	54
Planned Community	3.50	0	0	0	0
Public/Semi-Public	2.80	0	0	1,217	1,217
Urban Center	2.80	0	0	69	69
Undefined	3.00	0	0	0	0
Clark County Las Vegas Boulevard & Interstate 15	2.50	0	0	753	753
Total EDUs - All Land Uses		42	29	7,421	7,492

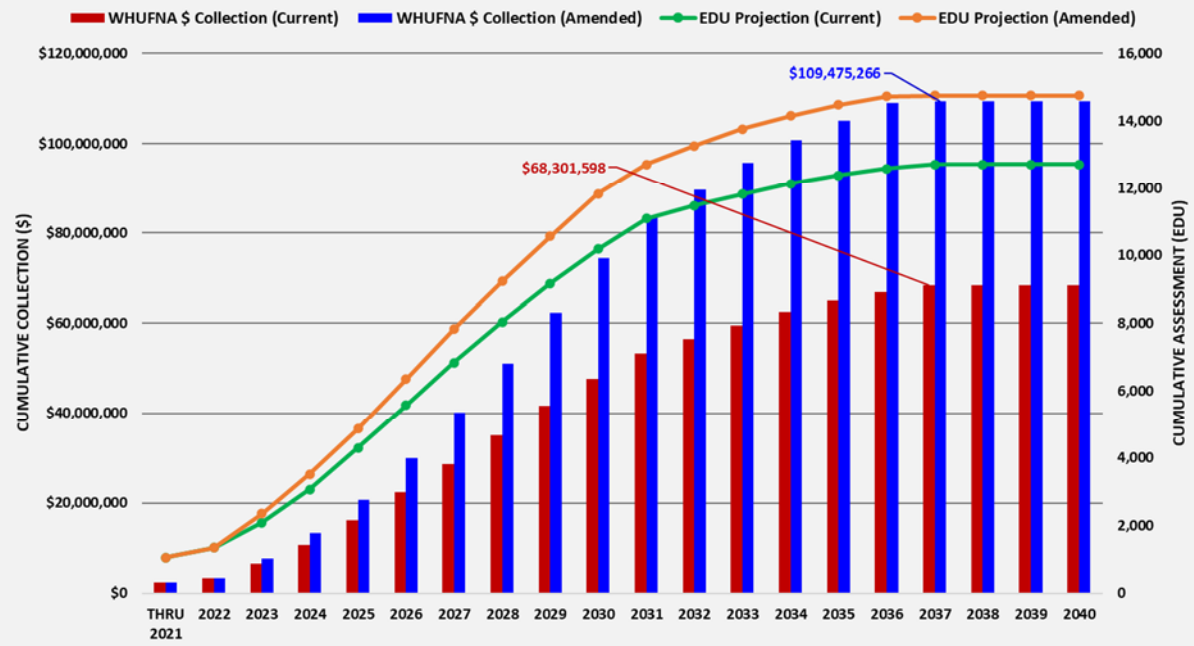
TABLE B.5 WEST HENDERSON EDUS + \$ PROJECTIONS (CURRENT + AMENDED)

YEAR	PROJECTED ¹		REVISED ²		PROJECTED ³		REVISED ⁴	
	ANNUAL EDUS	CUM EDUS	ANNUAL EDUS	CUM EDUS	ANNUAL \$	CUM \$	ANNUAL \$	CUM \$
THRU 2021	1,051	1,051	1,051	1,051	\$2,395,620	\$2,395,620	\$2,395,620	\$2,395,620
2022	293	1,343	293	1,343	\$957,701	\$3,353,321	\$957,701	\$3,353,321
2023	747	2,090	1,011	2,355	\$3,168,220	\$6,521,541	\$4,312,646	\$7,665,967
2024	980	3,070	1,165	3,519	\$4,195,815	\$10,717,356	\$5,673,388	\$13,339,355
2025	1,225	4,295	1,347	4,866	\$5,507,008	\$16,224,364	\$7,391,322	\$20,730,676
2026	1,273	5,568	1,484	6,350	\$6,083,321	\$22,307,685	\$9,209,123	\$29,939,799
2027	1,273	6,841	1,484	7,833	\$6,387,487	\$28,695,173	\$10,221,643	\$40,161,442
2028	1,199	8,040	1,404	9,237	\$6,401,169	\$35,096,341	\$10,790,873	\$50,952,316
2029	1,132	9,172	1,332	10,568	\$6,432,347	\$41,528,689	\$11,395,887	\$62,348,203
2030	1,019	10,191	1,267	11,835	\$6,078,568	\$47,607,257	\$12,039,126	\$74,387,329
2031	907	11,098	882	12,717	\$5,695,619	\$53,302,875	\$9,232,467	\$83,619,796
2032	386	11,484	554	13,271	\$3,234,218	\$56,537,093	\$6,147,826	\$89,767,622
2033	347	11,831	498	13,769	\$3,056,336	\$59,593,430	\$5,948,022	\$95,715,644
2034	313	12,144	399	14,168	\$2,888,238	\$62,481,667	\$5,115,299	\$100,830,942
2035	250	12,394	319	14,487	\$2,426,120	\$64,907,787	\$4,399,157	\$105,230,099
2036	200	12,594	255	14,742	\$2,037,941	\$66,945,728	\$3,783,275	\$109,013,374
2037	127	12,720	29	14,771	\$1,355,870	\$68,301,598	\$461,892	\$109,475,266
2038	0	12,720	0	14,771	\$0	\$68,301,598	\$0	\$109,475,266
2039	0	12,720	0	14,771	\$0	\$68,301,598	\$0	\$109,475,266
2040	0	12,720	0	14,771	\$0	\$68,301,598	\$0	\$109,475,266

NOTES:

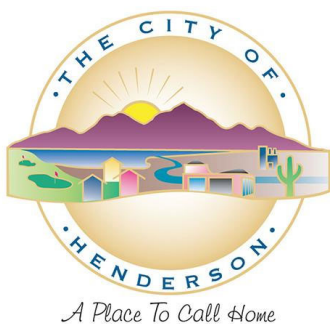
- 1 Projected EDUs based upon current assessment rate averaging 1.42 EDUs per developed acre.
- 2 Revised EDUs based upon proposed amendment to EDU factors that aligns with the SNWA RCC meter table
- 3 Projected \$ collection rate, based upon current projected # of EDUs and annual 5% rate increases through buildout.
- 4 Revised \$ collection rate, based upon proposed amendment to EDU factors that aligns with the SNWA RCC meter table, and proposed annual percentage rate increases.

FIGURE B.1 WEST HENDERSON WATER BACKBONE INFRASTRUCTURE - EDU + \$ PROJECTIONS (CURRENT + AMENDED)



Appendix C

WEST HENDERSON WATER INFRASTRUCTURE COST ESTIMATE UPDATE: R-43, R-43A, AND 36-INCH TRANSMISSION MAIN

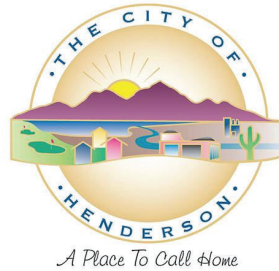


City of Henderson
West Henderson Water Infrastructure
Phasing Strategy - 2022 Update

Technical Memorandum
**WEST HENDERSON WATER
INFRASTRUCTURE COST ESTIMATE
UPDATE R-43, R-43A, AND 36-INCH
TRANSMISSION MAIN**

FINAL | July 2022





City of Henderson
West Henderson Water Infrastructure Phasing Strategy – 2022 Update

Technical Memorandum
WEST HENDERSON WATER INFRASTRUCTURE
COST ESTIMATE UPDATE
R-43, R-43A, AND 36-INCH TRANSMISSION MAIN

FINAL | July 2022

Digitally signed by Lisa M. Freestone
Contact Info: Carollo Engineers, Inc.
Date: 2022.07.25 07:15:32-0700'



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Abbreviations

AACE	Association for the Advancement of Cost Engineering
Carollo	Carollo Engineers, Inc.
CCI	Construction Cost Index
CDOL	Cost Data On-line
City	City of Henderson, Nevada
CMU	concrete masonry unit
EDU	equivalent dwelling unit
ENR	Engineering News Record
FCS-17	Flow Control Station 17
HUGS	Henderson Utility Guidelines
HVAC	heating, ventilation, and air conditioning
ksi	kips per square inch (kips = one thousand pounds)
LF	linear feet
MG	million gallons
mgd	million gallons per day
OH&P	Overhead & Profit
PLC	programmable logic controller
psi	pounds per square inch
R-42	Reservoir-42
R-43	Reservoir-43
R-43A	Reservoir-43A
ROFC	rate of flow control
UDACS	Uniform Design and Construction Standards

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Section 1

INTRODUCTION

1.1 Background

The City of Henderson, Nevada (City) continues to plan for and implement water infrastructure updates previously documented in *West Henderson Water Infrastructure Phasing Strategy Update*, prepared by Carollo Engineers, Inc. (Carollo) (2016). This planning-level study evaluated the required backbone water infrastructure for buildout development in the West Henderson planning area and included preliminary technical analysis and infrastructure cost opinions used to establish the cost per equivalent dwelling unit (EDU) for Phase 1 and Phase 2 for the West Henderson 2630 and 2760 pressure zones.

The City is currently updating the planning cost estimates included in 2016 due to changes in infrastructure requirements and escalation in project construction costs. The updated cost estimates will allow the City to establish an updated overall cost per EDU for the West Henderson Planning Area.

In support of the City's effort, Carollo has developed conceptual-level cost opinions for four West Henderson infrastructure components, including:

- Design and construction of a 4.0 million gallons (MG) concrete reservoir at Site Reservoir-43 (R-43) (U0706). Construction anticipated to be completed by January 1, 2030.
- Design and construction of a rate of flow control (ROFC) station at Reservoir-42 (R-42) (U0705). Construction anticipated to be completed by January 1, 2030.
- Design and construction of 6,000 linear feet (LF) of 36-inch transmission main to convey 25 million gallons per day (mgd) from R-43 to R-42 (U0705). Construction anticipated to be completed by January 1, 2030.
- Design and construction of a second 4.0 MG concrete reservoir at Site Reservoir-43A (R-43A) (expansion) (22U06). Construction anticipated to be completed by the year 2040.

The updated cost opinions are described in this Technical Memorandum.

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Section 2

ASSUMPTIONS AND DESIGN CRITERIA

The following paragraphs summarize the assumptions and design criteria used to develop the conceptual cost opinion.

2.1 General Assumptions and Design Criteria

The following general assumptions and conceptual design criteria apply to all infrastructure, unless otherwise noted, for the purpose of completing the cost opinions.

- Carollo developed conceptual cost opinions for the following elements:
 - 4.0 MG prestressed, aboveground concrete reservoir at Site R-43.
 - ROFC valve station, above grade, designed for flows up to 25 mgd.
 - 36-inch steel transmission main.
 - Second 4.0 MG prestressed, aboveground concrete reservoir at Site R-43A (expansion).
- Design conforms to Uniform Design and Construction Standards (UDACS) for Potable Water Systems and Henderson Utility Guidelines (HUGS) (August 2010).
- Property acquisition costs are not included in the conceptual cost opinion.
- All buried pipelines are assumed to be cement mortar-lined steel.
- Cathodic protection is required for buried pipelines in accordance with HUGS.

2.2 Transmission Main Design Criteria

Pipeline design criteria are summarized in Table 1. Assumptions related to the transmission main are as follows:

- Air release valves, isolation valves, and blowoff stations will be located at high/low points and typical intervals along the pipeline. Since design drawings for the pipeline are not available, these appurtenances were assumed to be located at every 1/2-mile interval.
- Valve vaults are required for isolation valves greater than 24-inch diameter.
- Minimum depth of cover is 72 inches.
- Soils can be excavated using standard heavy-duty earthmoving equipment.
- Trench boxes will be used for all trench excavations due to trench width limitations and excavation volumes needed for sloped excavations.
- Trenching costs are based on a pace of 200 LF per day.
- On-site soils should generally be suitable for backfill. Pipe bed and zone material is assumed to be imported Class B material.
- Pavement replacement is required under Casa Del Sol Drive.

Table 1 Transmission Main Design Criteria

Item	Units	Value
Buried Pipe Materials		
Material	-	Spiral weld steel per AWWA C200
Coating	-	Cement mortar with dielectric tape wrapping
Lining	-	Cement mortar
Joint type	-	Butt weld or double lap weld
Transmission Main Construction		
Total pipeline length	feet	6,000
Pipeline diameter	inch(es)	36
Pipeline material	-	Steel
Pressure rating	psi	200
Minimum yield point	ksi	36
Thickness	inch(es)	0.25
Minimum depth of cover	inch(es)	72
Cathodic protection	-	Passive system

Notes:

(1) Abbreviations: psi = pounds per square inch; ksi = kips per square inch (kips = one thousand pounds).

2.3 Concrete Reservoir Design Criteria

The concrete reservoir design criteria are summarized in Table 2. The cost opinion includes:

- Prestressed, aboveground concrete reservoirs.
- Reservoir site work, including clearing, grading and other work associated with a fully developed site.
- Electrical and instrumentation and controls.
- Piping interconnect between reservoirs.
- Stormwater retention, re-routing of existing site drainage as necessary, and overflow catchment/drainage.

The cost opinion does NOT include:

- Offsite piping/valving from to and from the reservoirs.

Table 2 Concrete Reservoir Design Criteria

Item	Units	Value
Number of Reservoirs	-	2
Capacity per reservoir, nominal	MG	4.0
Type	-	Prestressed, aboveground concrete with cast-in-place core

2.4 Rate of Flow Control Station Design Criteria

The ROFC station design criteria are summarized in Table 3. Assumptions related to the flow control station are as follows:

- The flow control station includes two flow control valves designed to accommodate the full range of design flows. With one valve out of service, the station firm capacity is 25 mgd.
- Flow control valves are hydraulically operated, pilot-controlled diaphragm-type valves.
- The flow control valves are housed in a concrete masonry building similar to the design of Flow Control Station 17 (FCS-17) and complying with local architectural design.
- Standby power is not included.

Table 3 Flow Control Station Design Criteria

Item	Units	Value
Number of flow control valves	-	2
Capacity range, per flow control valve	mgd	0-25
Flow control valve type	-	Hydraulically operated, pilot-controlled diaphragm valve
Manufacturer	-	Cla-Val
Process piping	-	Welded steel
Structural/Architectural	-	Split face and smooth face CMU construction
Mechanical	-	Dismantling joints and isolation valves included
HVAC	-	Air conditioning and heating included
Electrical	-	Loads for valve actuation, lighting, heating, and cooling
Instrumentation	-	PLC, magnetic flowmeter, and pressure transmitters included

Notes:

- (1) Abbreviations: CMU = concrete masonry unit; PLC = programmable logic controller; HVAC = heating, ventilation, and air conditioning.

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Section 3

CONCEPTUAL COST OPINION

3.1 Capital Cost Opinion

Carollo developed conceptual-level capital cost opinions for the four West Henderson water infrastructure components described above. Table 4 shows the conceptual cost opinions summary for the West Henderson infrastructure. The summary and detailed cost opinion spreadsheets are included in Appendix A.

The cost opinion was developed using a spreadsheet model and database that draws information on unit costs and construction data from bid tab summaries, vendor costing information from Carollo, 2022 Cost Data On-line (CDOL), and RS Means published unit costs. Budgetary quotes were solicited from suppliers for the reservoirs, transmission main steel pipe, flow control valves and are included in Appendix B.

The cost opinions are expressed in July 2022 dollars (corresponding 20-Cities Average Engineering News Record (ENR) Construction Cost Index (CCI) = 13,168). The cost opinion is consistent with Class 5 Estimates as defined by the Association for the Advancement of Cost Engineering (AACE) International. This level of engineering cost estimating is generally made with limited information, including proposed facility type, location, and capacity. Typical accuracy for Class 5 Estimates is expected to be in the range of -50 to +100 percent. This level of accuracy is appropriate for preliminary budget-level estimating.

Indirect cost factors applied in the cost opinion include:

1. **General Conditions:** 10 percent of total direct cost.
2. **Contractor Overhead and Profit (OH&P) and Risk:** 15 percent applied to total direct costs and general conditions.
3. **Contractor Liability Insurance Premiums and Bonds:** 3 percent applied to total direct costs, general conditions, and OH&P and risk.
4. **Sales Tax:** The sales tax for Henderson was calculated to be 8.38 percent and applied to total direct costs, general conditions, OH&P and risk, and contractor liability insurance premiums and bonds.
5. **Engineering, Administration, & Legal:** 15 percent applied to total construction cost.
6. **Estimating Contingency:** 25 percent contingency applied to total construction cost and engineering, administration, and legal.

Table 4 Conceptual Cost Opinions Summary

Component	4.0 MG Reservoir at R-43 (U0706)	Flow Control Station (U0705)	36-inch Transmission Main (U0705)	4.0 MG Reservoir at R-43A (Expansion, 22U06)
Direct Cost	\$7,830,000	\$930,000	\$2,560,000	\$6,330,000
Construction Cost	\$11,050,000	\$1,310,000	\$3,620,000	\$8,930,000
Engineering, Administration & Legal	\$1,660,000	\$200,000	\$540,000	\$1,340,000
Project Cost W/O Contingency	\$12,710,000	\$1,510,000	\$4,160,000	\$10,270,000
Estimating Contingency (25%)	\$3,180,000	\$380,000	\$1,040,000	\$2,570,000
Total Project Cost ¹	\$15,890,000	\$1,890,000	\$5,200,000	\$12,840,000

Notes:

(1) Total estimated project costs reflect current market conditions and thus do not account for inflation or the projected market conditions at the time the projects are projected to be constructed.

3.2 Analysis and Projection of Future Construction Costs

As shown in Table 4, the cost of the West Henderson Infrastructure is calculated in current (July 2022) dollars to reflect current market conditions. In Table 5, costs were projected for the expected construction completion dates of January 1, 2030, for the 4.0 MG Reservoir at Site R-43, the 36-inch transmission main, and the ROFC station, and January 1, 2040, for the 4.0 MG reservoir expansion at Site R-43A using the following formula:

$$F = (1 + i)^n$$

Where:

F is the future worth factor,

i is the discount rate, and

n is the number of years from July 2022.

The discount rate was assumed to be 3.5 percent per year. This discount rate represents the average rate of change in the ENR 20 Cities average CCI for the past five years (2017-2021). However, it is important to note that the current construction bidding environment is characterized by rapidly increasing costs and significant uncertainty that makes it difficult to accurately calculate and project construction costs. Table 5 shows the future worth summary for the West Henderson infrastructure.

Table 5 Future Worth Summary

Component	4.0 MG Reservoir at R-43 2030 Construction ⁽¹⁾ (U0706)	Flow Control Station 2030 Construction ⁽¹⁾ (U0705)	36-inch Transmission Main 2030 Construction ⁽¹⁾ (U0705)	4.0 MG Reservoir at R-43A Expansion 2040 Construction ⁽²⁾ (22U06)
Project Cost (2022)	\$15,890,000	\$1,890,000	\$5,200,000	\$12,840,000
Net Future Worth at i = 3.5%				
Future Value (low, -30%)	\$14,670,000	\$1,740,000	\$4,800,000	\$16,750,000
Future Value (avg)	\$20,960,000	\$2,490,000	\$6,860,000	\$23,930,000
Future Value (high, +50%)	\$31,440,000	\$3,740,000	\$10,290,000	\$35,900,000

Notes:

(1) Assumes a discount rate of 3.5 percent annually and a term of 8 years.

(2) Assumes a discount rate of 3.5 percent annually and a term of 18 years.

Appendix A

DETAILED COST OPINIONS

PROJECT SUMMARY

Project: West Henderson Water Infrastructure Phasing Strate
Client: City of Henderson
Location: Henderson, NV
Zip Code: 89002

Estimate Class: V
PIC: Lisa Freestone
PM: Kelley Newman
Date: July-2022
By: D. Swartzendruber

Carollo Job # 200861

Reviewed: J. Wesley

NO.	DESCRIPTION	TOTAL
01	4.0 MG Reservoir at R-43 (U0706)	\$7,830,000
02	Rate of Flow Control Valve Station (U0705)	\$930,000
03	36-inch Transmission Main (U0705)	\$2,560,000
04	4.0 MG Reservoir at R-43A (expansion, 22U06)	\$6,330,000
TOTAL DIRECT COST		\$17,650,000
	General Conditions	10.0% \$1,760,000
	General Contractor Overhead, Profit & Risk	15.0% \$2,900,000
	Bonds and Insurance	3.0% \$680,000
	Sales Tax	8.38% \$1,920,000
TOTAL INDIRECT COST		\$7,260,000
TOTAL CONSTRUCTION COST		\$24,910,000
	Engineering, Administration & Legal	15.0% \$3,740,000
PROJECT COST W/O CONTINGENCY		\$28,650,000
	Contingency	25.0% \$7,170,000
TOTAL PROJECT COST		\$35,820,000

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Division 03 – Concrete						
03_00_00	4.0 MG Prestressed Concrete Reservoir	1	LS	\$5,075,000.00	\$5,075,000	
	Total					\$5,075,000
Division 26 – Electrical						
26_00_00	Electrical and I&C (20%)	1	LS	\$1,000,000.00	\$1,000,000	
	Total					\$1,000,000
Division 32 – Exterior Improvements						
32_00_00	Site Work (25%)	1	LS	\$1,250,000.00	\$1,250,000	
	Total					\$1,250,000
Division 40 – Process Integration						
40_00_00	Yard Piping (10%)	1	LS	\$500,000.00	\$500,000	
	Total					\$500,000
	TOTAL DIRECT COST					\$7,830,000
	General Conditions	10%				\$780,000
	General Contractor Overhead, Profit & Risk	15%				\$1,290,000
	Bonds and Insurance	3%				\$300,000
	Sales Tax	8.38%				\$850,000
	TOTAL INDIRECT COSTS					\$3,220,000
	TOTAL CONSTRUCTION COST					\$11,050,000
	Engineering, Administration & Legal	15%				\$1,660,000
	PROJECT COST W/O CONTINGENCY					\$12,710,000
	Contingency	25%				\$3,180,000
	TOTAL PROJECT COST					\$15,890,000
Project Scope:	U0706 R-43, 4 MG					
	Above grade concrete reservoir. Site will have space allocated for future reservoir R-43A, 4 MG. Site piping will accommodate future connection to future R-43A.					

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Division 02 – Existing Conditions						
02_00_00	Civil	1	LS	\$100,000.00	\$100,000	
Total						\$100,000
Division 04 – Masonry						
04_00_00	Structural	1	LS	\$99,498.00	\$99,498	
Total						\$99,000
Division 08 – Openings						
08_00_00	Architectural	1	LS	\$79,818.00	\$79,818	
Total						\$80,000
Division 23 – Heating, Ventilating, and Air-Conditioning(HVAC)						
23_81_14 / 15732	8.5 Ton Midrange, Midrange Roof Top Heating And Cooling Unit, Convertible	1	EA	\$13,658.91	\$13,659	
Total						\$14,000
Division 26 – Electrical						
26_00_00	Electrical and I&C	1	LS	\$250,000.00	\$250,000	
Total						\$250,000
Division 40 – Process Integration						
40_00_00	Flow Control Valve	2	EA	\$66,500.00	\$133,000	
40_00_00	20" Magnetic Flowmeter	2	EA	\$20,475.00	\$40,950	
40_00_00	Adjustable Pipe Support	6	EA	\$5,985.00	\$35,910	
40_05_06.03 / 15121	20" Dismantling Joint	2	EA	\$6,374.69	\$12,749	
40_05_24 / 15252	24" 3/8" (Std) Wall A-234 Buttweld Straight	2	EA	\$6,032.02	\$12,064	
40_05_24 / 15252	24" X 20" 3/8" (Std) Wall A-234 Buttwld	4	EA	\$14,648.07	\$58,592	
40_05_24 / 15252	24" 3/8" (Std) Wall 90° Lr Buttweld Ell	4	EA	\$6,667.21	\$26,669	
40_05_24 / 15252	24"A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	50	LF	\$459.71	\$22,985	
40_05_24 / 15252	20"A-53 Wld Steel 3/8" (Std) Wall Pipe In A Bldg	20	LF	\$383.61	\$7,672	
40_05_64 / 15112	20" 150# Fxf Awwa Butterfly Valve, No Op	4	EA	\$9,492.97	\$37,972	
Total						\$389,000
TOTAL DIRECT COST						\$930,000
General Conditions		10%				\$90,000
General Contractor Overhead, Profit & Risk		15%				\$150,000
Bonds and Insurance		3%				\$40,000
Sales Tax		8.38%				\$100,000
TOTAL INDIRECT COSTS						\$380,000
TOTAL CONSTRUCTION COST						\$1,310,000
Engineering, Administration & Legal		15%				\$200,000
PROJECT COST W/O CONTINGENCY						\$1,510,000
Contingency		25%				\$380,000
TOTAL PROJECT COST						\$1,890,000
Project Scope:						
U0705 PZ 2760 36-Inch West Transmission Main Flow Control Station at R-42 and approximately 6,000 LF of 36-inch transmission main to flow 25 MGD from Site 43 to Site 42.						
Provide for maintenance outage of R-42. Conversion of R-42 inlet pipe to outlet pipe for the 2630 PZ.						

DETAILED COST OPINION

Project: West Henderson Water Infrastructure
Client: City of Henderson
Location: Henderson, NV
Element: 02 36" Transmission Main (U0705)

Format: MASTER FORMAT 50
Date : July-2022
By : D. Swartzendruber
Reviewed: J. Wesley

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Division 09 – Finishes						
09_00_00	Corrosion Testing Station Allowance	1	LS	\$51,257.00	\$51,257	
	Total					\$51,000
Division 31 – Earthwork						
31_00_00	Pipeline Install	6000	LF	\$60.00	\$360,000	
	Total					\$360,000
Division 32 – Exterior Improvements						
32_00_00	Traffic Control	200	LF	\$58.00	\$11,600	
32_00_00	Pavement Demo and Repair	178	SY	\$116.41	\$20,721	
	Total					\$32,000
Division 33 – Utilities						
33_00_00	Isolation Valve Vault	2	EA	\$57,920.00	\$115,840	
	Total					\$116,000
Division 40 – Process Integration						
40_00_00	Air Release Valve Assembly	2	EA	\$22,616.00	\$45,232	
40_00_00	Blowoff Assembly	2	EA	\$23,679.00	\$47,358	
40_00_00	Water Main Testing	6000	LF	\$7.38	\$44,280	
40_00_00	Carbon Steel Butt Weld or Double Lap Weld, 36" DIA	120	EA	\$1,827.00	\$219,240	
40_05_24 / 15252	36" C200 1/4" Wall Wld Cs Pipe In Open	6000	LF	\$260.00	\$1,560,000	
40_05_24 / 15252	36" 3/8" (Std) Wall A-234 Buttweld Straight Tee	2	EA	\$29,141.98	\$58,284	
40_05_24 / 15252	36" 3/8" Wall 90° Lr Buttweld Ell	2	EA	\$12,661.87	\$25,324	
	Total					\$2,000,000
	TOTAL DIRECT COST					\$2,560,000
	General Conditions	10%				\$260,000
	General Contractor Overhead, Profit & Risk	15%				\$420,000
	Bonds and Insurance	3%				\$100,000
	Sales Tax	8.38%				\$280,000
	TOTAL INDIRECT COSTS					\$1,060,000
	TOTAL CONSTRUCTION COST					\$3,620,000
	Engineering, Administration & Legal	15%				\$540,000
	PROJECT COST W/O CONTINGENCY					\$4,160,000
	Contingency	25%				\$1,040,000
	TOTAL PROJECT COST					\$5,200,000
Project Scope:	U0705 PZ 2760 36-Inch West Transmission Main Flow Control Station at R-42 and approximately 6,000 LF of 36-inch transmission main to flow 25 MGD from Site 43 to Site 42. Provide for maintenance outage of R-42. Conversion of R-42 inlet pipe to outlet pipe for the 2630 PZ.					

DETAILED COST OPINION

Project: West Henderson Water Infrastructure
Client: City of Henderson
Location: Henderson, NV
Element: 04 4.0 MG Reservoir at R43A (expansion, 22U06)

Format: MASTER FORMAT 50
Date : July-2022
By : D. Swartzendruber
Reviewed: J. Wesley

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Division 03 – Concrete						
03_00_03	4.0 MG Prestressed Concrete Reservoir	1	LS	\$5,075,000.00	\$5,075,000	
	Total					\$5,075,000
Division 26 – Electrical						
26_00_00	Electrical and I&C (15%)	1	LS	\$750,000.00	\$750,000	
	Total					\$750,000
Division 32 – Exterior Improvements						
32_00_00	Site Work (5%)	1	LS	\$250,000.00	\$250,000	
	Total					\$250,000
Division 40 – Process Integration						
40_00_00	Yard Piping (5%)	1	LS	\$250,000.00	\$250,000	
	Total					\$250,000
TOTAL DIRECT COST						\$6,330,000
	General Conditions	10%				\$630,000
	General Contractor Overhead, Profit & Risk	15%				\$1,040,000
	Bonds and Insurance	3%				\$240,000
	Sales Tax	8.38%				\$690,000
TOTAL INDIRECT COSTS						\$2,600,000
TOTAL CONSTRUCTION COST						\$8,930,000
	Engineering, Administration & Legal	15%				\$1,340,000
PROJECT COST W/O CONTINGENCY						\$10,270,000
	Contingency	25%				\$2,570,000
TOTAL PROJECT COST						\$12,840,000
Project Scope:	22U06 R-43A, 4 MG Expansion					
	Design and construct a 4 MG concrete reservoir at Site #43 in West Henderson					

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Appendix B

EQUIPMENT QUOTES

Derek Swartzendruber

From: Sudol, Sean <Sean.Sudol@dntanks.com>
Sent: Tuesday, March 22, 2022 4:04 PM
To: David Geisler
Cc: Derek Swartzendruber
Subject: RE: West Henderson - Reservoir R-43 Budget Quote DN Tanks01081910

David,

Please see below for a budgetary estimate for the design and construction of an AWWA D110 Type I tank for the City of Henderson. As I believe you know, this is for the tank structure complete, including concrete floor slab and spread footing, prestressed concrete tank core walls, column supported concrete roof slab, exterior shotcrete prestressing strand, shotcrete cover and appurtenances as detailed (The City of Henderson has some particular preferences for appurtenances that notable cost to the structure). These costs have escalated significantly over the last year due to material shortages. The estimate does not include earthwork, subgrade improvement, SCADA, piping, electrical, or other ancillary facilities. Additional assumptions include:

- Design throughout 2022 with construction of the tank beginning in Spring 2023
- Competent soils, no need for deep foundations
- Does not include General contractor mark up, this is DN Tanks subcontract price assumed provided price to GC
- The tank will be built at grade or uniformly buried around the tank wall (No soil load on the roof)

4,000,000 Gallon D110 Prestressed Tank

- Inner Diameter: 180'
- Side Water Depth: 22'
- Freeboard: 1'
- Roof Type: Column Supported Flat Slab
- Appurtenances:
 - (4) Custom Fabricated COH Steel Roof Vents
 - (1) Concrete Overflow Weir Box per COH Requirements
 - (1) 4' x 4' Aluminum Roof Hatch
 - (1) 4' x 8' Aluminum Roof Hatch
 - (1) 316 SS Interior Ladder w/ Saf-T Climb
 - (1) Full Height Galvanized Steel Exterior Staircase w/ Landing
 - (3) Galvanized Steel Pipe Brackets for Exterior Overflow
 - (3) 316 SS 6" Roof Sleeves
 - 565 LF of galvanized steel handrail around full circumference of roof
- Budgetary Price: **\$5,075,000**

I hope you find this information helpful. Once there is a geotechnical report to review, we are happy to support and begin the process of preparing performance plans and specs. If you have any questions, don't hesitate to let me know. I look forward to working with you and other tank projects in the future!

Best regards,

Sean

Sean Sudol, PE

Regional Manager – Southwest

(619) 820-5327 - Mobile Phone

3234 N. Scottsdale Rd., Scottsdale, AZ 85251

www.dntanks.com



From: David Geisler <DGeisler@carollo.com>
Sent: Thursday, March 17, 2022 11:05 AM
To: Sudol,Sean <Sean.Sudol@dntanks.com>
Cc: Derek Swartzendruber <dswartzendruber@carollo.com>
Subject: West Henderson - Reservoir R-43 Budget Quote

This message originated from outside DN Tanks

Sean;

We spoke in early November regarding a prestressed tank (R-47) for the City of Henderson. We are also evaluating a new 4MG prestressed tank in West Henderson (R-43). As part of our scope, we submitted a preliminary cost estimate to Henderson in February with a cost of \$4.5M for the reservoir. They have since asked us to obtain a formal budget level vendor quote for R-43. The estimated dimensions of the tank are 180ft diameter x 22ft tall fully above grade. The estimate should full design by DN and include any standard City of Henderson adders and HUG requirements. Construction start timeframe would be early 2023.

Would you be able to provide a budget quote by mid next week that we can include in our updated memorandum? Let me know.

Thank you.

David A Geisler, PE

Principal Structural Engineer | Associate Vice President
4600 East Washington Street, Suite 500 | Phoenix, AZ 85034

o 602.263.9500 | d 602.474.4143

dgeisler@carollo.com | carollo.com



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Derek Swartzendruber

From: Homero Garcia <hgarcia@cla-val.com>
Sent: Monday, January 31, 2022 3:48 PM
To: Derek Swartzendruber
Subject: RE: Pricing and sizing for flow control valve

Derek,

Good morning. Please see the model number and pricing for an electronic control valve.

24" Flow Control Valves. (Matching existing valve model at SBWTP)
131-22BCEFNP SY KOX D/S CL150FL – Flanged
w/Pilot Isolation Valves, Close Speed Control, Position Transmitter, Ind. Pressure Supply, VC-22D, Pressure Gauges 0-200, Open Speed Control, Y-Strainer, Epoxy Coated, SST trim, Class 150 Flanges
X= Full SST Pilot System
Budgetary Cost \$ 66,500.00

Regards,

Homero Garcia Jr.
Area Sales Manager – Arizona
602.859.3201
Hgarcia@Cla-Val.com



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[Mining & Industrial Products](#)
- [Aviation & Ground Fueling Products](#)

From: Derek Swartzendruber <dswartzendruber@carollo.com>
Sent: Wednesday, January 26, 2022 8:35 AM
To: Homero Garcia <hgarcia@cla-val.com>
Subject: RE: Pricing and sizing for flow control valve

Homero,

I'm working with pretty limited design info for this estimate, so let's say:

- Inlet Pressure Max: 160 ft
- Outlet Pressure Min: 10 ft

Thanks for the data sheet. From what I can tell, the 40-01 is a manual control valve. Could we also get pricing on the 131-01 electronic control valve?

It looks like that is the same valve but has a solenoid and electronic valve controller.

Thanks,

Derek

From: Homero Garcia <hgarcia@cla-val.com>
Sent: Tuesday, January 25, 2022 4:32 PM
To: Derek Swartzendruber <dswartzendruber@carollo.com>
Subject: RE: Pricing and sizing for flow control valve

Derek,

Good afternoon. Please see valve size recommendations. Please provide anticipated upstream and downstream pressures. I have the factory working on pricing and lead time. I have attached the data sheet for your reference.

24" Hydraulic Flow Control Valve
40-01 BCPSY KCX D/S CL150FL
w/pilot isolation valves, closing speed control, pressure gauges 0-200, open speed control, y-strainer
epoxy coating, ductile iron body, Stainless Steel Trim, CDHS18 Pilot, 20" Bore on X52E Orifice Plate
X=Full Stainless Steel Pilot System

Regards,

Homero Garcia Jr.
Area Sales Manager – Arizona
602.859.3201
Hgarcia@Cla-Val.com



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From: Derek Swartzendruber <dswartzendruber@carollo.com>
Sent: Monday, January 24, 2022 12:03 PM
To: Homero Garcia <hgarcia@cla-val.com>; Brett Carne <bcarne@cla-val.com>
Subject: Pricing and sizing for flow control valve

Hi Homero and Brett,

I'm working on a class 5 conceptual estimate for a client near Las Vegas and need pricing/sizing confirmation for a flow control valve (model 40-01 and 640-01).

Our design flow rate is ~17,500 gpm through a 36" steel transmission main. From your literature, it looks like for the 36" Valve/Pipe size we will want a 20" bore. Please let me know if we can go with a smaller valve size.

36" Valve / Pipe Size			
Bore Size	Flow - gpm		
	Min.	Max.	Nominal
26.00	20000	60000	35000
24.00	16000	48500	28000
22.00	13000	39000	22500
21.00	12000	35000	20500
20.00	10500	31000	18000
19.00	9500	28000	16000
18.00	8500	24500	14500
17.00	7500	22000	12500
16.00	6500	19300	11000
15.00	5600	16900	9800
14.00	4900	14600	8500
13.00	4200	12600	7300

Other design info includes:

- Pressure Class 150 Flanged
- ASTM A216 WCB Cast Steel
- Cast Steel Body and Cover
- Cast Steel disc retainer and diaphragm washer

Thanks,

Derek Swartzendruber (he/him/his)

Staff Professional

One South Church Avenue, Suite 1820 | Tucson, AZ 85701

☎ 520.230.4715 | ☎ 574.318.0115

dswartzendruber@carollo.com | carollo.com



Derek Swartzendruber

From: Sneed, Andy <ASneed@american-usa.com>
Sent: Tuesday, July 12, 2022 8:35 AM
To: Derek Swartzendruber
Cc: Robinson, Wyatt
Subject: RE: AMERICAN Website Inquiry Follow Up

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Derek-

Steel Coil costing has been reduced since the beginning of this year, however freight has substantially increased. Below are more current budget prices for 30"/36"

- 36" I.D. X 0.250" Steel Pipe, CML x Polyurethane, Lap Weld Joints, 50' nom. Lengths - \$260 / LF.
- Adder for Rolled Grooved Gasketed Joints in lieu of Lap Weld - \$10 / LF
- 30" I.D. X 0.250" Steel Pipe, CML x Polyurethane, Lap Weld Joints, 50' nom. Lengths - \$225 / LF.
- Adder for Rolled Grooved Gasketed Joints in lieu of Lap Weld - \$9 / LF

Andrew G. Sneed, P.E.
Regional Sales Manager – Business Development (West)
AMERICAN Ductile Iron Pipe / AMERICAN SpiralWeld Pipe
asneed@american-usa.com
303.506.0653



From: Derek Swartzendruber <dswartzendruber@carollo.com>
Sent: Friday, July 8, 2022 10:29 AM
To: Sneed, Andy <ASneed@american-usa.com>
Cc: Robinson, Wyatt <wrobinson@american-usa.com>
Subject: RE: AMERICAN Website Inquiry Follow Up

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That sounds good to me.

Thanks!

From: Sneed, Andy <ASneed@american-usa.com>
Sent: Friday, July 8, 2022 10:19 AM
To: Derek Swartzendruber <dswartzendruber@carollo.com>

Appendix D

ESCALATED PROJECT COSTS

Table D.1 Escalated Project Costs

PROJECT*	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	UPDATED AMOUNT (April 14, 2022)	% WHUFNA
MAY 3, 2022 OPTION (COST UPDATED AUGUST 16TH)																						
Inflation Index - Annual	0.00%	0.00%	7.50%	5.00%	3.00%	3.00%	2.00%	2.00%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%		
Inflation Index - Cumulative	100.00%	100.00%	107.50%	112.88%	116.26%	119.75%	122.14%	124.59%	126.46%	128.35%	130.28%	132.23%	134.22%	136.23%	138.27%	140.35%	142.45%	144.59%	146.76%	148.96%		
PROJECT*	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	UPDATED AMOUNT (May 3, 2022)	% WHUFNA
WHUFNA FUNDED CASH FLOW (CAPITAL)	\$ 3,373,421	\$ 10,114,017	\$ 23,248,618	\$ 12,859,035	\$ -	\$ -	\$ 816,150	\$ 2,099,375	\$ 6,175,100	\$ 4,560,875	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 449,400	\$ 2,022,300	\$ 2,022,300	\$ 67,740,591	
WHUFNA FUNDED CASH FLOW (OPERATING)	\$ 127,809	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 127,809	
COH NON-WHUFNA FUNDED CASH FLOW	\$ 1,528,605	\$ 1,024,180	\$ 8,256,650	\$ 7,807,165	\$ -	\$ -	\$ 1,664,850	\$ 3,846,125	\$ 10,451,400	\$ 7,006,125	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 834,600	\$ 3,755,700	\$ 3,755,700	\$ 49,931,100	42.4%
Combined WHUFNA Cost Total	\$ 3,501,230	\$ 10,114,017	\$ 23,248,618	\$ 12,859,035	\$ -	\$ -	\$ 816,150	\$ 2,099,375	\$ 6,175,100	\$ 4,560,875	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 449,400	\$ 2,022,300	\$ 2,022,300	\$ 67,868,400	57.6%
																					\$ 117,799,500	
Combined WHUFNA Inflated Cost Total	\$ 3,501,230	\$ 10,114,017	\$ 24,992,264	\$ 14,514,636	\$ -	\$ -	\$ 996,879	\$ 2,615,547	\$ 7,808,769	\$ 5,854,001	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 649,780	\$ 2,967,868	\$ 3,012,386	\$ 77,027,378	55.57%
COH Non-WHUFNA Inflated Cost Total	\$ 1,528,605	\$ 1,024,180	\$ 8,875,898	\$ 8,812,337	\$ -	\$ -	\$ 2,033,516	\$ 4,791,770	\$ 13,216,397	\$ 8,992,543	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,206,733	\$ 5,511,755	\$ 5,594,431	\$ 61,588,166	44.43%