Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply

Chapter III - Appendix A
Cash Flow Model Outputs

West Basin Municipal Water District

Final Report
July 30, 2021

Submitted by

in association with RAFTELIS

Appendix A – Cash Flow Model Outputs

GHD Advisory

APPENDIX A - MEMORANDUM

DBB Delivery Model - Cash Flow Analysis Outputs (no risk-adjustments)

Cost Benefit Analysis - Ocean Water Desalination Project - Task 2

Note: This sheet only for the purpose of delivery model analysis as outlined in GHD Task Memorandum 2, Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply, West Basin Municipal Water District (2020). These outputs must be viewed in conjunction with the assumptions, limitations and disclaimers contained in the Task 2 Memorandum.

Key Inputs

Discount rate	3.5%	*(nominal)*
Delivery Model		***DBB***
MWD LRP Rebate option	Option A	*$340/AF for first 25 years of operation*
MET rate scenario	Base Case	

Key Modelling assumptions

Inflation	2.5%	*(nominal)*	Power esc.	4.0%	*(nominal)*
Capital esc.	3.0%	*(nominal)*	Power cost	$0.12	*/kWh in 2023*
OPEX esc.	2.5%	*(nominal)*	MET rate esc.	3.5%	*(nominal) beyond 2028*
GHG offset esc.	4.0%	*(nominal)*	GHG price	$20	*/MTeq in 2023*

Overview of Project Assumptions

All monetary values in 2019 real dollars	CAPEX ($ mil)	Fixed OPEX ($ mil/yr)	Var OPEX ($/1000 gal)	Water production (AFY)	Elec consump. (kWh/1000 gal)
Current Project Design	$514	$5.0	$0.14	21283	13.0
Subsurface Intake Design	$740	$5.3	$0.14	21283	13.2

Financing and delivery assumptions

Scenario: Design-Bid-Build (100% public financing w. municipal bonds)

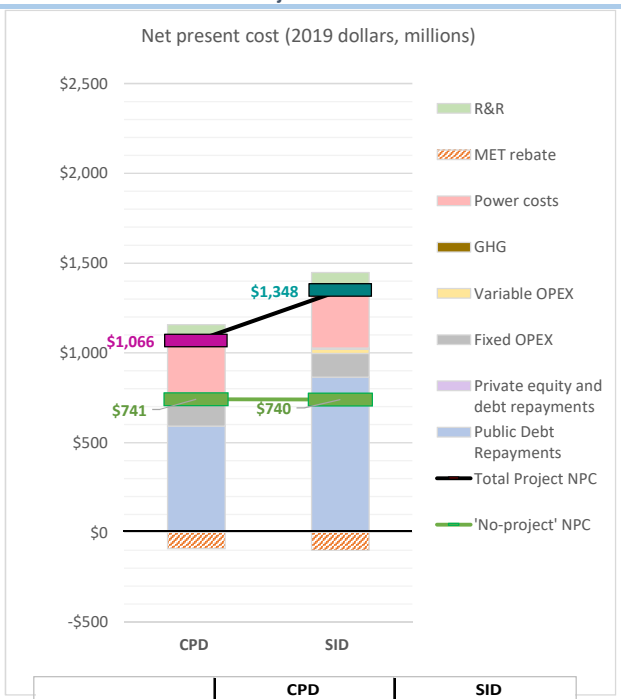
Debt to equity split	100% / 0%		$0	*million grant funding*
Weighted avg. interest rate	4.5%	*(nominal)*		

Model Outputs - w.out risk adjustments

	Project NPC ($ million)	Equivalent 'no-project' NPC ($ million)	Net present cost compared to 'no project' ($ million)
Current Project Design	$1,066	$741	**-$325**
Subsurface Intake Design	$1,348	$740	**-$608**

Negative values indicate lifetime costs of the OWDP project are greater than 'no project' scenario

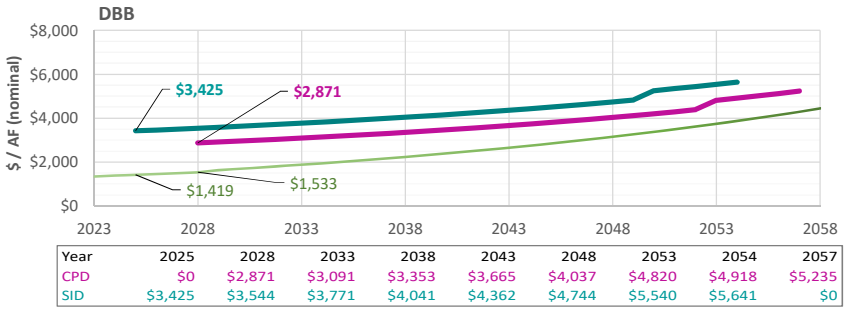
NPC breakdown - w.out risk adjustments



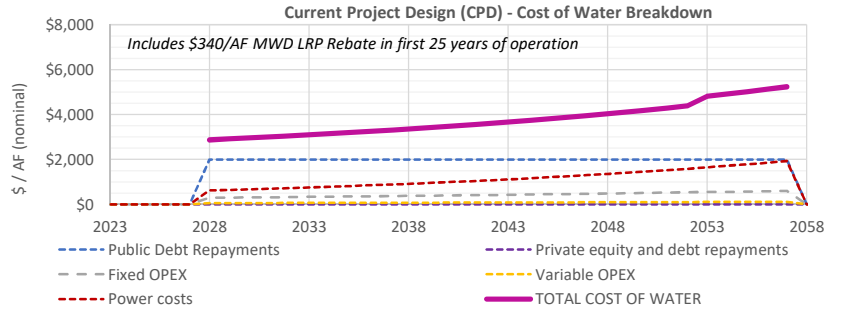
	CPD		SID	
Debt repayments	$592	56%	$865	64%
Equity repayments	$0	0%	$0	0%
Fixed OPEX	$120	11%	$132	10%
Variable OPEX	$23	2%	$24	2%
Power costs	$311	29%	$311	23%
GHG	$6	1%	$6	0%
R&R	$103	10%	$111	8%
MET rebate	-$91	-8%	-$100	-7%
TOTAL	**$1,066**		**$1,348**	

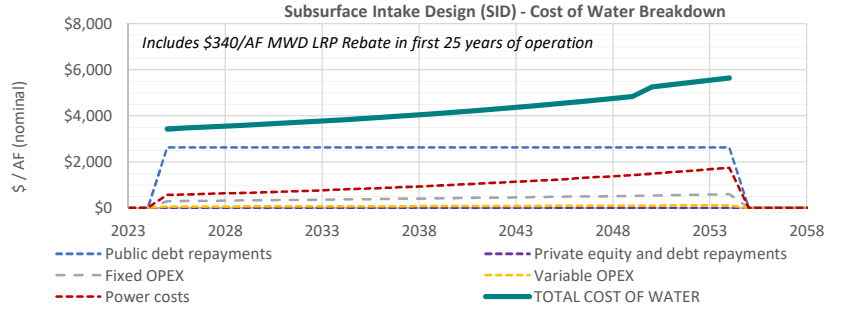
Percentages show proportion of total NPC

Cost of water - w.out risk adjustments



Year	2025	2028	2033	2038	2043	2048	2053	2054	2057
CPD	$0	$2,871	$3,091	$3,353	$3,665	$4,037	$4,820	$4,918	$5,235
SID	$3,425	$3,544	$3,771	$4,041	$4,362	$4,744	$5,540	$5,641	$0





GHD Advisory

APPENDIX A - MEMORANDUM

DBFOM - 10% Delivery Model - Cash Flow Analysis Outputs (no risk-adjustments)

Cost Benefit Analysis - Ocean Water Desalination Project - Task 2

Note: This sheet only for the purpose of delivery model analysis as outlined in GHD Task Memorandum 2, Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply, West Basin Municipal Water District (2020). These outputs must be viewed in conjunction with the assumptions, limitations and disclaimers contained in the Task 2 Memorandum.

Key Inputs

Discount rate	3.5%	*(nominal)*
Delivery Model		***DBFOM - 10%***
MWD LRP Rebate option	Option A	*$340/AF for first 25 years of operation*
MET rate scenario	Base Case	

Key Modelling assumptions

Inflation	2.5%	*(nominal)*	Power esc.	4.0%	*(nominal)*
Capital esc.	3.0%	*(nominal)*	Power cost	$0.12	*/kWh in 2023*
OPEX esc.	2.5%	*(nominal)*	MET rate esc.	3.5%	*(nominal) beyond 2028*
GHG offset esc.	4.0%	*(nominal)*	GHG price	$20	*/MTeq in 2023*

Overview of Project Assumptions

All monetary values in 2019 real dollars	CAPEX ($ mil)	Fixed OPEX ($ mil/yr)	Var OPEX ($/1000 gal)	Water production (AFY)	Elec consump. (kWh/1000 gal)
Current Project Design	$514	$5.0	$0.14	21283	13.0
Subsurface Intake Design	$740	$5.3	$0.14	21283	13.2

Financing and delivery assumptions

Scenario: Design-Build-Finance-Operate-Maintain with 10% private financing

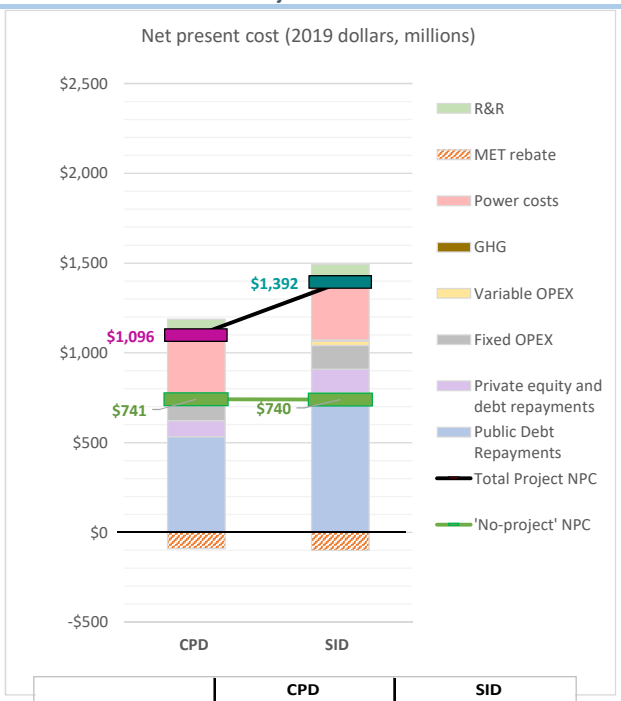
Debt to equity split	90% / 10%		$0	*million grant funding*
Weighted avg. interest rate	4.8%	*(nominal)*		

Model Outputs - w.out risk adjustments

	Project NPC ($ million)	Equivalent 'no-project' NPC ($ million)	Net present cost compared to 'no project' ($ million)
Current Project Design	$1,096	$741	**-$355**
Subsurface Intake Design	$1,392	$740	**-$652**

Negative values indicate lifetime costs of the OWDP project are greater than 'no project' scenario

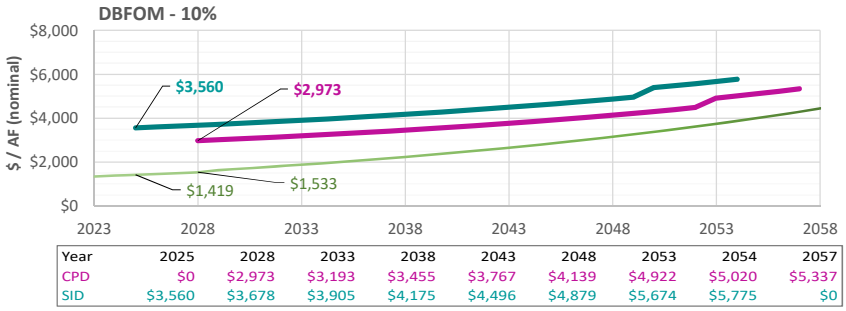
NPC breakdown - w.out risk adjustments



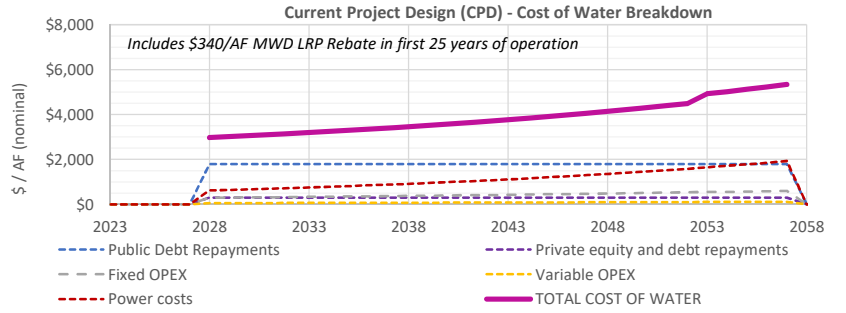
	CPD		SID	
Debt repayments	$533	49%	$778	56%
Equity repayments	$90	8%	$131	9%
Fixed OPEX	$120	11%	$132	9%
Variable OPEX	$23	2%	$24	2%
Power costs	$311	28%	$311	22%
GHG	$6	1%	$6	0%
R&R	$103	9%	$111	8%
MET rebate	-$91	-8%	-$100	-7%
TOTAL	**$1,096**		**$1,392**	

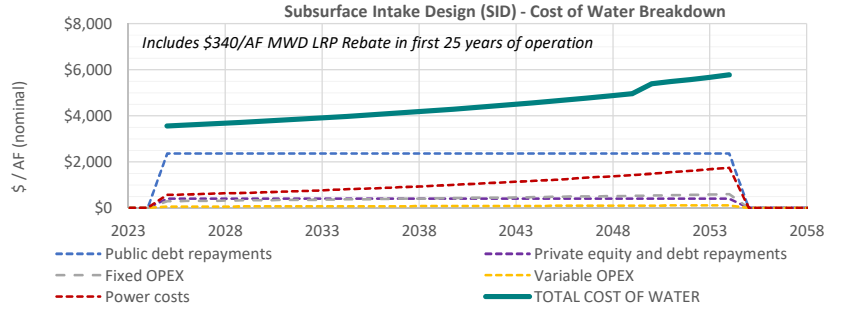
Percentages show proportion of total NPC

Cost of water - w.out risk adjustments



Year	2025	2028	2033	2038	2043	2048	2053	2054	2057
CPD	$0	$2,973	$3,193	$3,455	$3,767	$4,139	$4,922	$5,020	$5,337
SID	$3,560	$3,678	$3,905	$4,175	$4,496	$4,879	$5,674	$5,775	$0





GHD Advisory

APPENDIX A - MEMORANDUM

DBFOM - 50% Delivery Model - Cash Flow Analysis Outputs (no risk-adjustments)

Cost Benefit Analysis - Ocean Water Desalination Project - Task 2

Note: This sheet only for the purpose of delivery model analysis as outlined in GHD Task Memorandum 2, Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply, West Basin Municipal Water District (2020). These outputs must be viewed in conjunction with the assumptions, limitations and disclaimers contained in the Task 2 Memorandum.

Key Inputs

Discount rate	3.5%	*(nominal)*
Delivery Model		***DBFOM - 50%***
MWD LRP Rebate option	Option A	*$340/AF for first 25 years of operation*
MET rate scenario	Base Case	

Key Modelling assumptions

Inflation	2.5%	*(nominal)*	Power esc.	4.0%	*(nominal)*
Capital esc.	3.0%	*(nominal)*	Power cost	$0.12	*/kWh in 2023*
OPEX esc.	2.5%	*(nominal)*	MET rate esc.	3.5%	*(nominal) beyond 2028*
GHG offset esc.	4.0%	*(nominal)*	GHG price	$20	*/MTeq in 2023*

Overview of Project Assumptions

All monetary values in 2019 real dollars	CAPEX ($ mil)	Fixed OPEX ($ mil/yr)	Var OPEX ($/1000 gal)	Water production (AFY)	Elec consump. (kWh/1000 gal)
Current Project Design	$514	$5.0	$0.14	21283	13.0
Subsurface Intake Design	$740	$5.3	$0.14	21283	13.2

Financing and delivery assumptions

Scenario: Design-Build-Finance-Operate-Maintain with 50% private financing

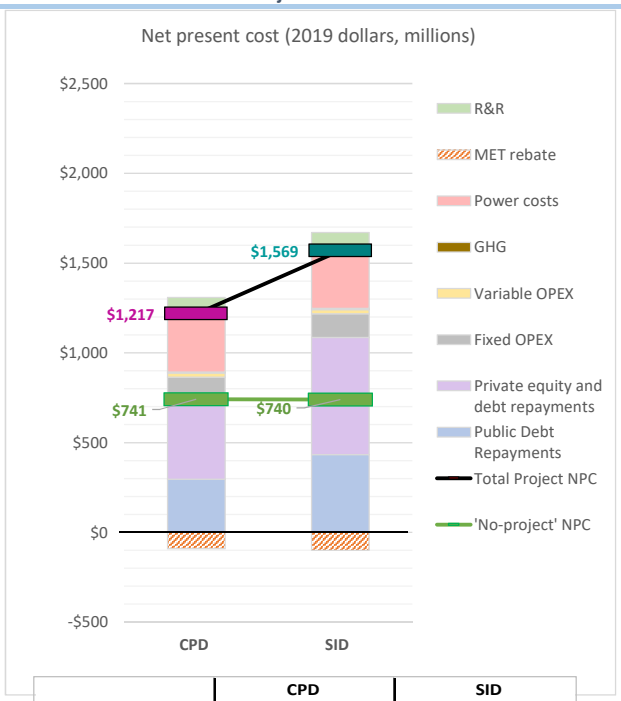
Debt to equity split	50% / 50%		$0	*million grant funding*
Weighted avg. interest rate	6.2%	*(nominal)*		

Model Outputs - w.out risk adjustments

	Project NPC ($ million)	Equivalent 'no-project' NPC ($ million)	Net present cost compared to 'no project' ($ million)
Current Project Design	$1,217	$741	**-$476**
Subsurface Intake Design	$1,569	$740	**-$829**

Negative values indicate lifetime costs of the OWDP project are greater than 'no project' scenario

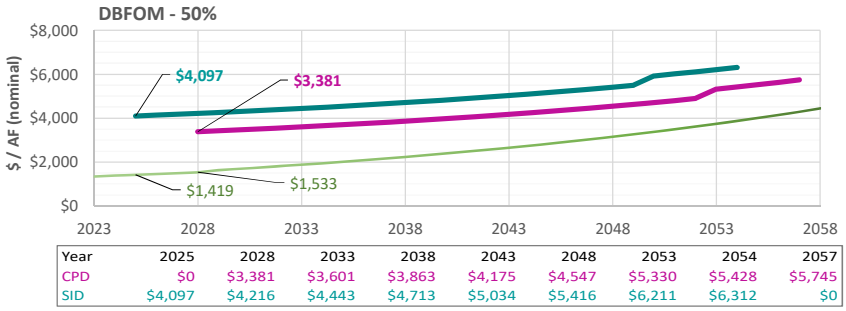
NPC breakdown - w.out risk adjustments



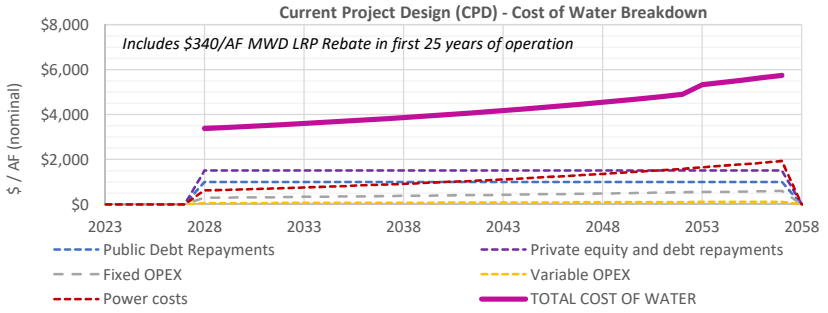
	CPD		SID	
Debt repayments	$296	24%	$432	28%
Equity repayments	$448	37%	$654	42%
Fixed OPEX	$120	10%	$132	8%
Variable OPEX	$23	2%	$24	2%
Power costs	$311	26%	$311	20%
GHG	$6	1%	$6	0%
R&R	$103	8%	$111	7%
MET rebate	-$91	-7%	-$100	-6%
TOTAL	**$1,217**		**$1,569**	

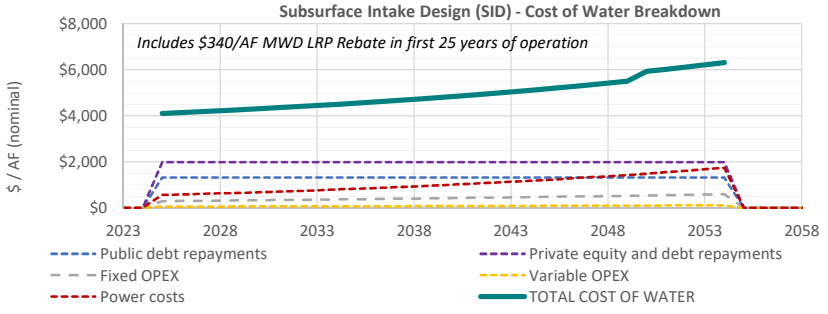
Percentages show proportion of total NPC

Cost of water - w.out risk adjustments



Year	2025	2028	2033	2038	2043	2048	2053	2054	2057
CPD	$0	$3,381	$3,601	$3,863	$4,175	$4,547	$5,330	$5,428	$5,745
SID	$4,097	$4,216	$4,443	$4,713	$5,034	$5,416	$6,211	$6,312	$0





GHD Advisory

APPENDIX A - MEMORANDUM

DBFOM - 100% Delivery Model - Cash Flow Analysis Outputs (no risk-adjustments)

Cost Benefit Analysis - Ocean Water Desalination Project - Task 2

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Key Inputs

Discount rate	3.5%	*(nominal)*
Delivery Model		***DBFOM - 100%***
MWD LRP Rebate option	Option A	*$340/AF for first 25 years of operation*
MET rate scenario	Base Case	

Key Modelling assumptions

Inflation	2.5%	*(nominal)*	Power esc.	4.0%	*(nominal)*
Capital esc.	3.0%	*(nominal)*	Power cost	$0.12	*/kWh in 2023*
OPEX esc.	2.5%	*(nominal)*	MET rate esc.	3.5%	*(nominal) beyond 2028*
GHG offset esc.	4.0%	*(nominal)*	GHG price	$20	*/MTeq in 2023*

Overview of Project Assumptions

All monetary values in 2019 real dollars	CAPEX ($ mil)	Fixed OPEX ($ mil/yr)	Var OPEX ($/1000 gal)	Water production (AFY)	Elec consump. (kWh/1000 gal)
Current Project Design	$514	$5.0	$0.14	21283	13.0
Subsurface Intake Design	$740	$5.3	$0.14	21283	13.2

Financing and delivery assumptions

Scenario: Design-Build-Finance-Operate-Maintain with 100% private financing

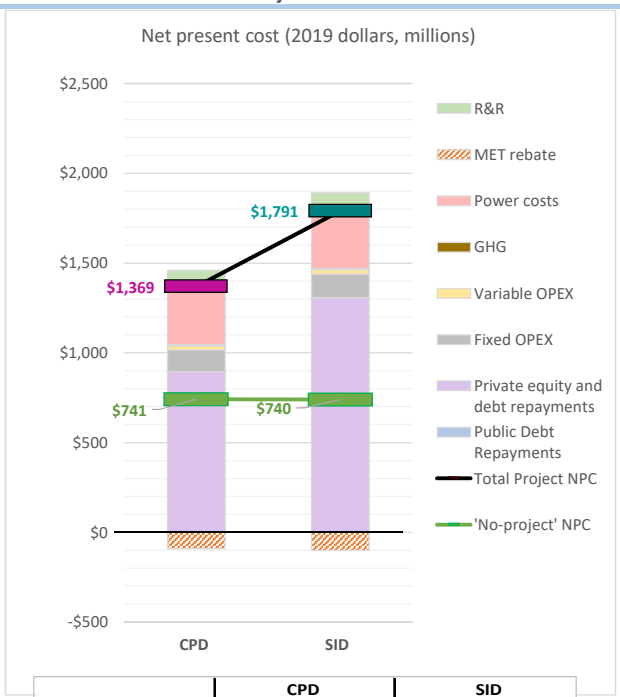
Debt to equity split	0% / 100%		$0	*million grant funding*
Weighted avg. interest rate	7.8%	*(nominal)*		

Model Outputs - w.out risk adjustments

	Project NPC ($ million)	Equivalent 'no-project' NPC ($ million)	Net present cost compared to 'no project' ($ million)
Current Project Design	$1,369	$741	**-$628**
Subsurface Intake Design	$1,791	$740	**-$1,051**

Negative values indicate lifetime costs of the OWDP project are greater than 'no project' scenario

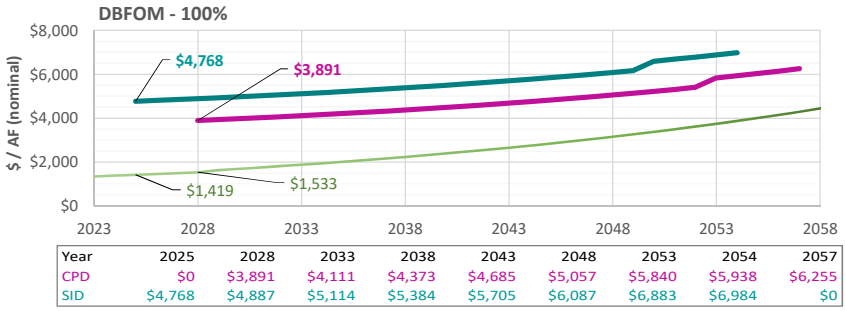
NPC breakdown - w.out risk adjustments



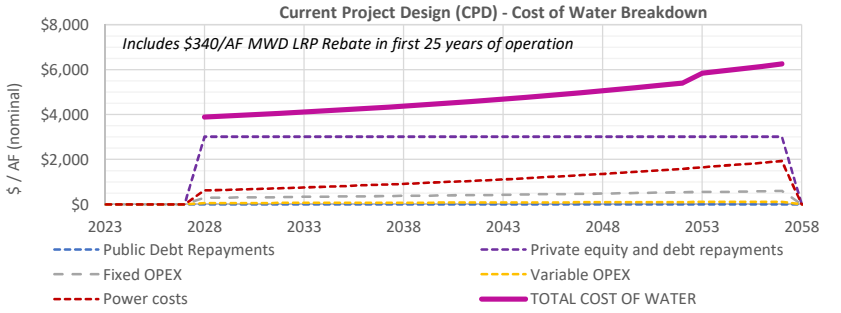
	CPD		SID	
Debt repayments	$0	0%	$0	0%
Equity repayments	$896	65%	$1,308	73%
Fixed OPEX	$120	9%	$132	7%
Variable OPEX	$23	2%	$24	1%
Power costs	$311	23%	$311	17%
GHG	$6	0%	$6	0%
R&R	$103	8%	$111	6%
MET rebate	-$91	-7%	-$100	-6%
TOTAL	**$1,369**		**$1,791**	

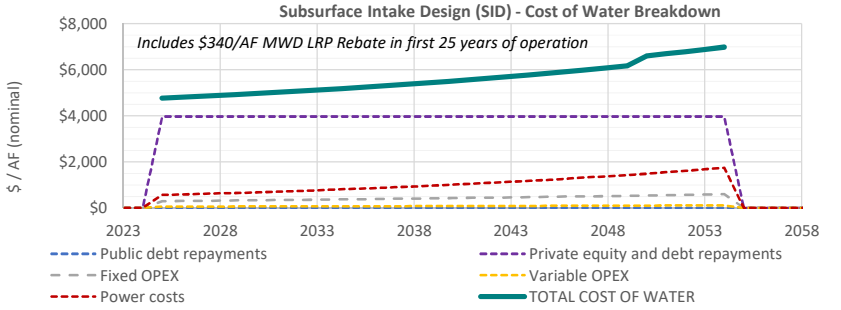
Percentages show proportion of total NPC

Cost of water - w.out risk adjustments



Year	2025	2028	2033	2038	2043	2048	2053	2054	2057
CPD	$0	$3,891	$4,111	$4,373	$4,685	$5,057	$5,840	$5,938	$6,255
SID	$4,768	$4,887	$5,114	$5,384	$5,705	$6,087	$6,883	$6,984	$0





GHD Advisory

APPENDIX A - MEMORANDUM

DBOM Delivery Model - Cash Flow Analysis Outputs (no risk-adjustments)

Cost Benefit Analysis - Ocean Water Desalination Project - Task 2

Note: This sheet only for the purpose of delivery model analysis as outlined in GHD Task Memorandum 2, Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply, West Basin Municipal Water District (2020). These outputs must be viewed in conjunction with the assumptions, limitations and disclaimers contained in the Task 2 Memorandum.

Key Inputs

Discount rate	3.5%	*(nominal)*
Delivery Model		***DBOM***
MWD LRP Rebate option	Option A	*$340/AF for first 25 years of operation*
MET rate scenario	Base Case	

Key Modelling assumptions

Inflation	2.5%	*(nominal)*	Power esc.	4.0%	*(nominal)*
Capital esc.	3.0%	*(nominal)*	Power cost	$0.12	*/kWh in 2023*
OPEX esc.	2.5%	*(nominal)*	MET rate esc.	3.5%	*(nominal) beyond 2028*
GHG offset esc.	4.0%	*(nominal)*	GHG price	$20	*/MTeq in 2023*

Overview of Project Assumptions

All monetary values in 2019 real dollars	CAPEX ($ mil)	Fixed OPEX ($ mil/yr)	Var OPEX ($/1000 gal)	Water production (AFY)	Elec consump. (kWh/1000 gal)
Current Project Design	$514	$5.0	$0.14	21283	13.0
Subsurface Intake Design	$740	$5.3	$0.14	21283	13.2

Financing and delivery assumptions

Scenario: Design-build-operate-maintain with 100% public financing

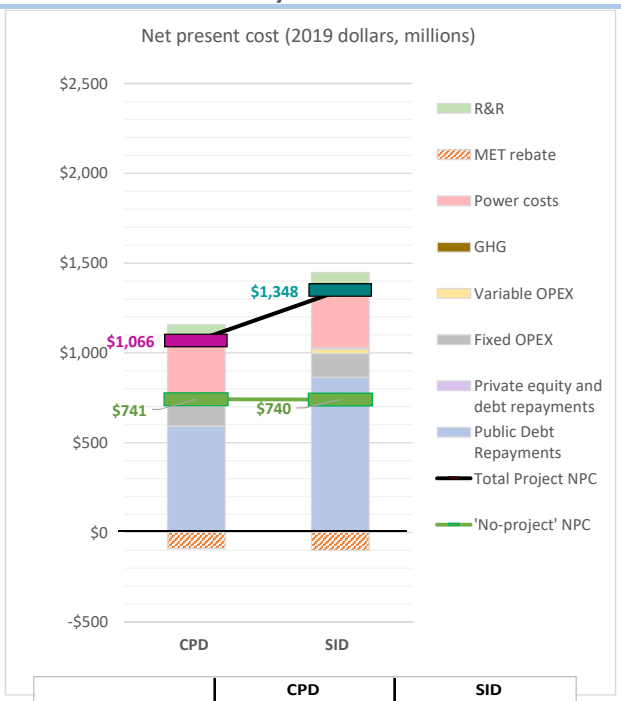
Debt to equity split	100% / 0%		$0	*million grant funding*
Weighted avg. interest rate	4.5%	*(nominal)*		

Model Outputs - w.out risk adjustments

	Project NPC ($ million)	Equivalent 'no-project' NPC ($ million)	Net present cost compared to 'no project' ($ million)
Current Project Design	$1,066	$741	**-$325**
Subsurface Intake Design	$1,348	$740	**-$608**

Negative values indicate lifetime costs of the OWDP project are greater than 'no project' scenario

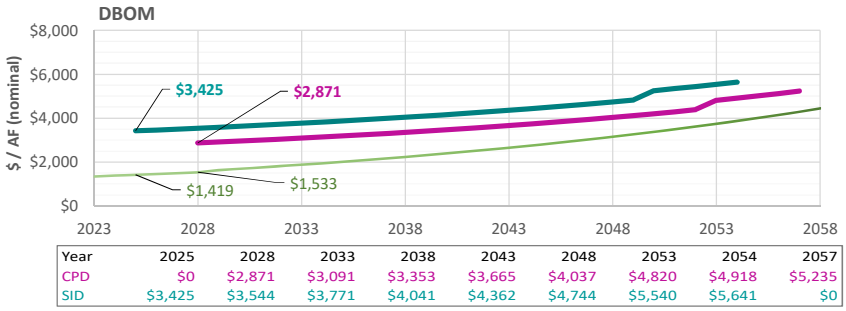
NPC breakdown - w.out risk adjustments



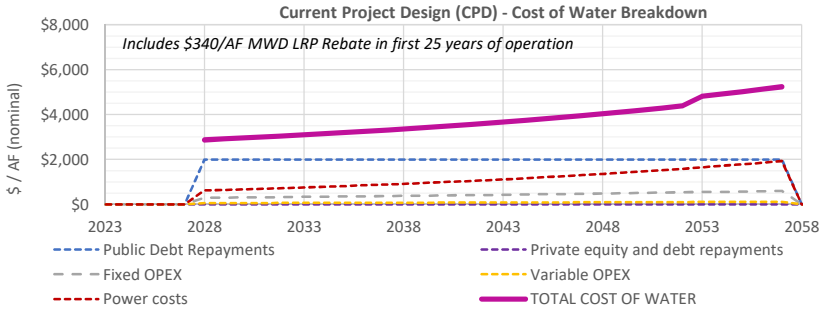
	CPD		SID	
Debt repayments	$592	56%	$865	64%
Equity repayments	$0	0%	$0	0%
Fixed OPEX	$120	11%	$132	10%
Variable OPEX	$23	2%	$24	2%
Power costs	$311	29%	$311	23%
GHG	$6	1%	$6	0%
R&R	$103	10%	$111	8%
MET rebate	-$91	-8%	-$100	-7%
TOTAL	**$1,066**		**$1,348**	

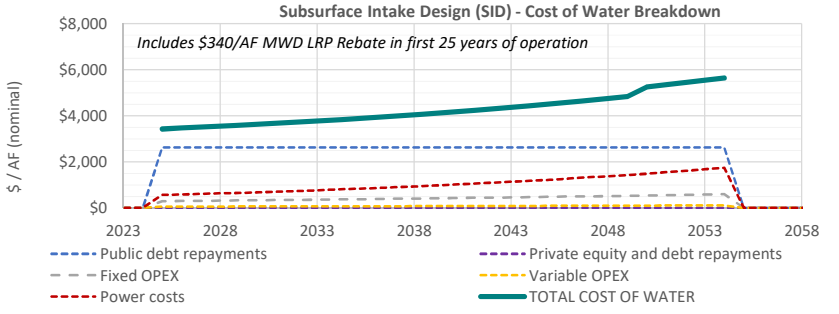
Percentages show proportion of total NPC

Cost of water - w.out risk adjustments



Year	2025	2028	2033	2038	2043	2048	2053	2054	2057
CPD	$0	$2,871	$3,091	$3,353	$3,665	$4,037	$4,820	$4,918	$5,235
SID	$3,425	$3,544	$3,771	$4,041	$4,362	$4,744	$5,540	$5,641	$0





GHD Advisory

APPENDIX A - MEMORANDUM

PPP Delivery Model - Cash Flow Analysis Outputs (no risk-adjustments)

Cost Benefit Analysis - Ocean Water Desalination Project - Task 2

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Key Inputs

Discount rate	3.5%	*(nominal)*
Delivery Model		***PPP***
MWD LRP Rebate option	Option A	*$340/AF for first 25 years of operation*
MET rate scenario	Base Case	

Key Modelling assumptions

Inflation	2.5%	*(nominal)*	Power esc.	4.0%	*(nominal)*
Capital esc.	3.0%	*(nominal)*	Power cost	$0.12	*/kWh in 2023*
OPEX esc.	2.5%	*(nominal)*	MET rate esc.	3.5%	*(nominal) beyond 2028*
GHG offset esc.	4.0%	*(nominal)*	GHG price	$20	*/MTeq in 2023*

Overview of Project Assumptions

All monetary values in 2019 real dollars	CAPEX ($ mil)	Fixed OPEX ($ mil/yr)	Var OPEX ($/1000 gal)	Water production (AFY)	Elec consump. (kWh/1000 gal)
Current Project Design	$514	$5.0	$0.14	21283	13.0
Subsurface Intake Design	$740	$5.3	$0.14	21283	13.2

Financing and delivery assumptions

Scenario: Public-Private Partnership (P3) via a Water Purchase Agreement (WPA)

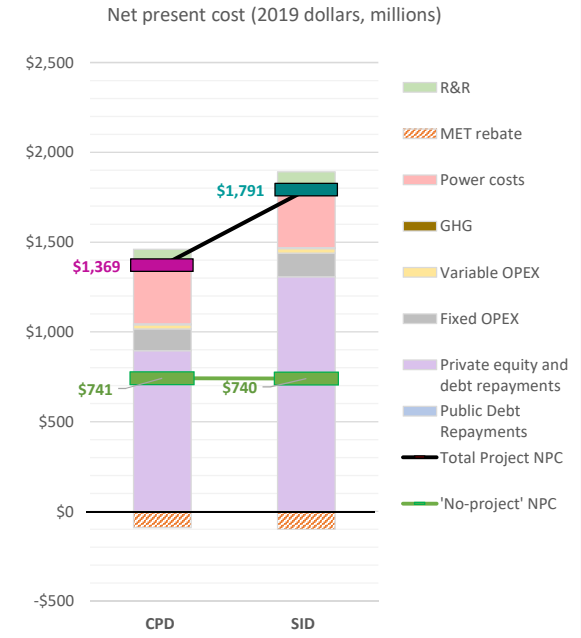
Debt to equity split	0% / 100%		$0	*million grant funding*
Weighted avg. interest rate	7.8%	*(nominal)*		

Model Outputs - w.out risk adjustments

	Project NPC ($ million)	Equivalent 'no-project' NPC ($ million)	Net present cost compared to 'no project' ($ million)
Current Project Design	$1,369	$741	**-$628**
Subsurface Intake Design	$1,791	$740	**-$1,051**

Negative values indicate lifetime costs of the OWDP project are greater than 'no project' scenario

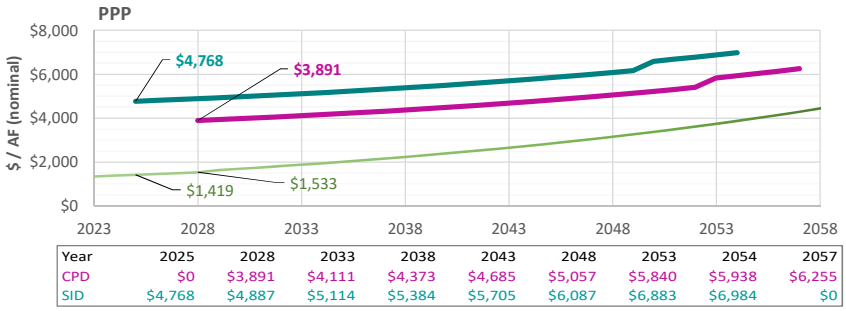
NPC breakdown - w.out risk adjustments



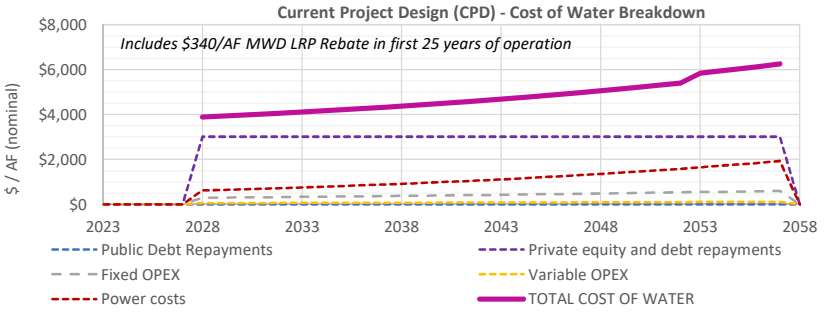
	CPD		SID	
Debt repayments	$0	0%	$0	0%
Equity repayments	$896	65%	$1,308	73%
Fixed OPEX	$120	9%	$132	7%
Variable OPEX	$23	2%	$24	1%
Power costs	$311	23%	$311	17%
GHG	$6	0%	$6	0%
R&R	$103	8%	$111	6%
MET rebate	-$91	-7%	-$100	-6%
TOTAL	**$1,369**		**$1,791**	

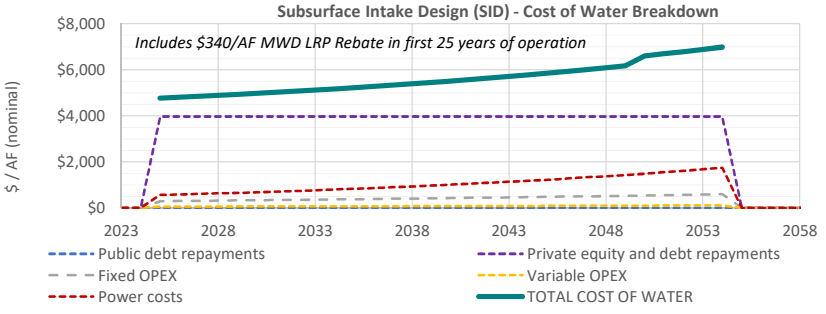
Percentages show proportion of total NPC

Cost of water - w.out risk adjustments



Year	2025	2028	2033	2038	2043	2048	2053	2054	2057
CPD	$0	$3,891	$4,111	$4,373	$4,685	$5,057	$5,840	$5,938	$6,255
SID	$4,768	$4,887	$5,114	$5,384	$5,705	$6,087	$6,883	$6,984	$0





GHD Advisory

APPENDIX A - MEMORANDUM

DBOM w. 50% SRF funding Delivery Model - Cash Flow Analysis Outputs (no risk-adjustments)

Cost Benefit Analysis - Ocean Water Desalination Project - Task 2

Note: This sheet only for the purpose of delivery model analysis as outlined in GHD Task Memorandum 2, Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply, West Basin Municipal Water District (2020). These outputs must be viewed in conjunction with the assumptions, limitations and disclaimers contained in the Task 2 Memorandum.

Key Inputs

Discount rate	3.5%	*(nominal)*
Delivery Model		***DBOM w. 50% SRF funding***
MWD LRP Rebate option	Option A	*$340/AF for first 25 years of operation*
MET rate scenario	Base Case	

Key Modelling assumptions

Inflation	2.5%	*(nominal)*	Power esc.	4.0%	*(nominal)*
Capital esc.	3.0%	*(nominal)*	Power cost	$0.12	*/kWh in 2023*
OPEX esc.	2.5%	*(nominal)*	MET rate esc.	3.5%	*(nominal) beyond 2028*
GHG offset esc.	4.0%	*(nominal)*	GHG price	$20	*/MTeq in 2023*

Overview of Project Assumptions

All monetary values in 2019 real dollars	CAPEX ($ mil)	Fixed OPEX ($ mil/yr)	Var OPEX ($/1000 gal)	Water production (AFY)	Elec consump. (kWh/1000 gal)
Current Project Design	$514	$5.0	$0.14	21283	13.0
Subsurface Intake Design	$740	$5.3	$0.14	21283	13.2

Financing and delivery assumptions

Scenario: Design-Bid-Build (Fully public financing split b/w DWSRF loan and muncipal bonds)

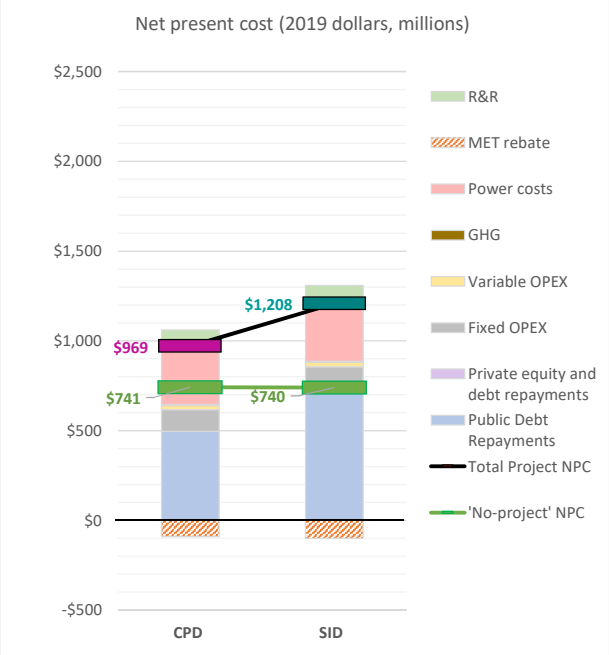
Debt to equity split	100% / 0%		$0	*million grant funding*
Weighted avg. interest rate	3.3%	*(nominal)*		

Model Outputs - w.out risk adjustments

	Project NPC ($ million)	Equivalent 'no-project' NPC ($ million)	Net present cost compared to 'no project' ($ million)
Current Project Design	$969	$741	**-$228**
Subsurface Intake Design	$1,208	$740	**-$468**

Negative values indicate lifetime costs of the OWDP project are greater than 'no project' scenario

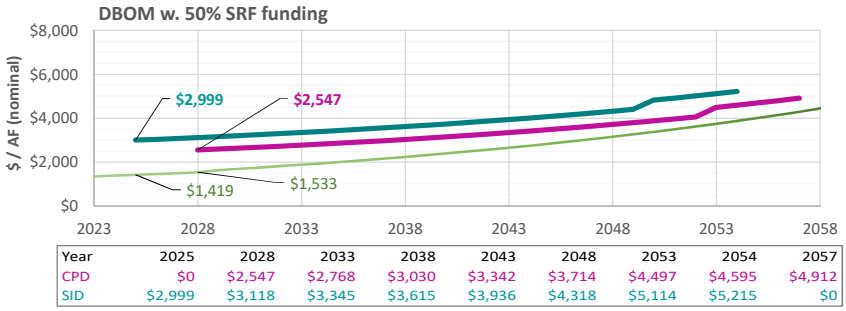
NPC breakdown - w.out risk adjustments



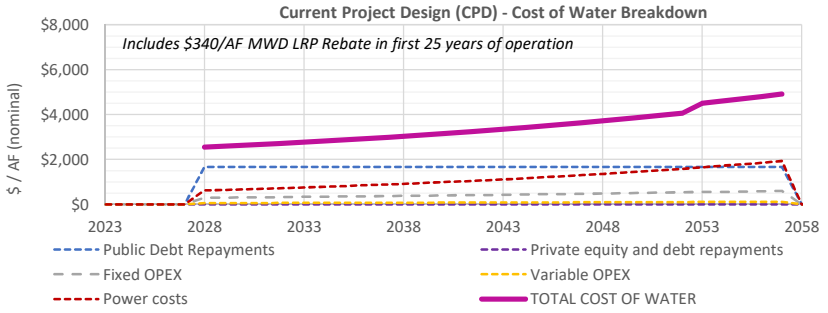
	CPD		SID	
Debt repayments	$496	51%	$725	60%
Equity repayments	$0	0%	$0	0%
Fixed OPEX	$120	12%	$132	11%
Variable OPEX	$23	2%	$24	2%
Power costs	$311	32%	$311	26%
GHG	$6	1%	$6	1%
R&R	$103	11%	$111	9%
MET rebate	-$91	-9%	-$100	-8%
TOTAL	**$969**		**$1,208**	

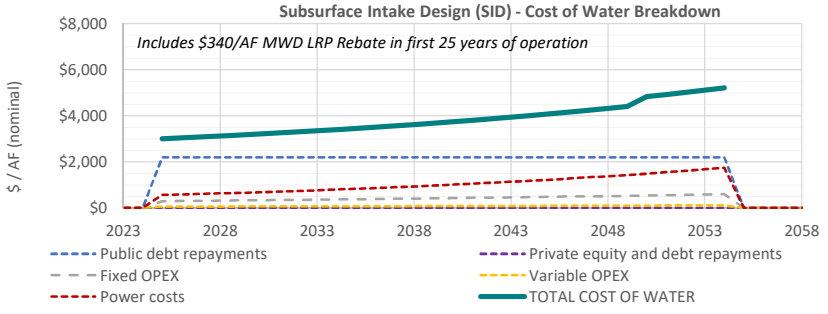
Percentages show proportion of total NPC

Cost of water - w.out risk adjustments



Year	2025	2028	2033	2038	2043	2048	2053	2054	2057
CPD	$0	$2,547	$2,768	$3,030	$3,342	$3,714	$4,497	$4,595	$4,912
SID	$2,999	$3,118	$3,345	$3,615	$3,936	$4,318	$5,114	$5,215	$0





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https://projects-northamerica.ghd.com/sites/uswest1/wbmwddesalcostbenefi/ProjectDocs/FINAL DELIVERABLES/Chapter III - Proj Delivery Method and Incentive Eval - Evaluation of Costs and Benefits of OWDP.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Final Draft	Nikhil Khurana	Mark Donovan		Mark Donovan		
Final	Nikhil Khurana	Mark Donovan		Mark Donovan		July 30, 2021

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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