Caso de estudio

27 September, 2021

This report is generated by WaterProof (http://water-proof.org/) in order to ptovide an indicate pre-feasibiity assessment regarding the potential of NbS.

From this documento you can have a synthesis of the result of indicators

This case study is based on:

CS_1_Tester_27-08-2021	
City: Lima Country: Perú Region: Americas Time frame (years): 30	Number of water intakes that are part of the analysis: 2 Number of DWTP in the analysis: 2 Currency: USD

Water intakes that are part of the analysis

Water Intake	System caracteristics
Intake_1_Tester_27-08-2021, to see click here	River
	Extraction connection
	Side Intake
	Pipeline
	Desander
	Pipeline
Intake_2_Tester_27-08-2021, to see click here	River
	Extraction connection
	Side Intake
	Pipeline
	Desander
	Pipeline

Caracteristics case study (Drinking water systems)

Drinking water Tratament plant	Nombre intake
PTAP_1_Tester_27-08-2021, to see click here	Filtration by membranes - Level 1
	Sludge Treatment
	Quick mix
	Sedimentation
	PTAP Input
	Filtration by membranes - Level 2
	Filtration by membranes - Level 4
	Ion exchange
	Slow mix
	Filtration
	Filtration by membranes - Level 3
	Disinfection
	Dosign of chemical products
PTAP_2_Tester_27-08-2021, to see click here	Filtration by membranes - Level 4
	Ion exchange
	Filtration
	Slow mix
	Dosign of chemical products
	PTAP Input
	Sedimentation
	Filtration by membranes - Level 1
	Filtration by membranes - Level 3
	Sludge Treatment
	Disinfection
	Filtration by membranes - Level 2
	Quick mix
PTAP_3_Tester_27-08-2021, to see click here	Filtration by membranes - Level 2
	Sludge Treatment
	Filtration by membranes - Level 3
	Ion exchange
	Sedimentation
	Dosign of chemical products
	PTAP Input
	Slow mix
	Filtration by membranes - Level 1
	Filtration by membranes - Level 4
	Filtration
	Disinfection
	Quick mix

Nature Based Solutions Conservation Activities

Name	Percentage of benefit associated with intervenctions at time t=0	Benefit	Implementation cost	Matenance cost	Periodicity maintenance	Opportunity cost
00002_Restauracion Pasiva (Tester Alpha V3)	Combinación de acciones que facilitan la regeneración natural de los sistemas. Estas acciones buscan principalmente reti	20.000	2,800.00	360.00	1.00	5,000.00
00001_Conservacion del Bosque (Tester Alpha V3)	Acciones que buscan conservar la cobertura actual mediante la firma de acuerdos de conservación, el pago a guardabosques	1.000	2,800.00	360.00	1.00	5,000.00

Financial parameters

Financial parameters

Platform cost year 1 (US$/yr)	250,310.06
Discount rate (%)	0.05
Sensivity analysis - Minimum discount rate (%)	0.03
Sensivity analysis - Maximum discount rate (%)	0.07

Porfolio objetives

Erosion Control for Drinking Water Quality

Erosion Control for Reservoir Maintenance

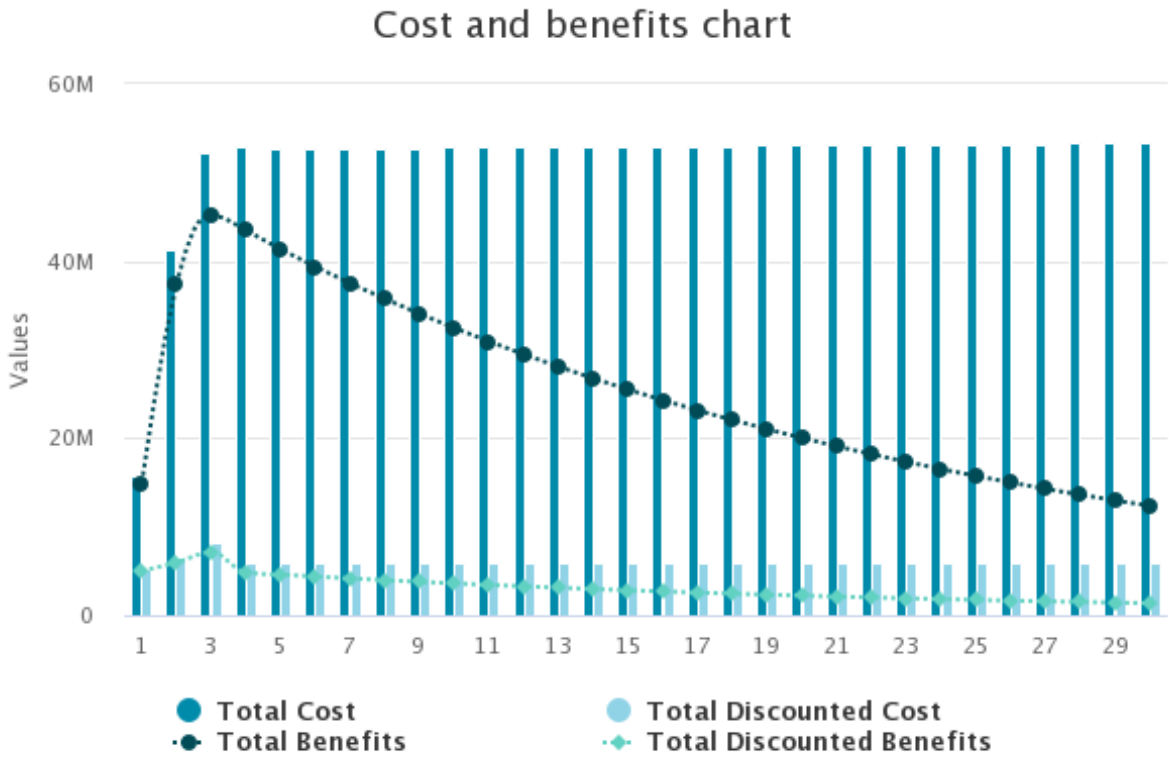
Nutrient Retention (Phosphorus)

Nutrient Retention (Nitrogen)

Analysis parameters

Implementation time of Nature-Based solution (yr)	3
ROI analysis time (yr)	30
Climate selection for baseline and NBS scenario analysis	HISTORIC

Comparative graph of costs and benefits for the analysis period

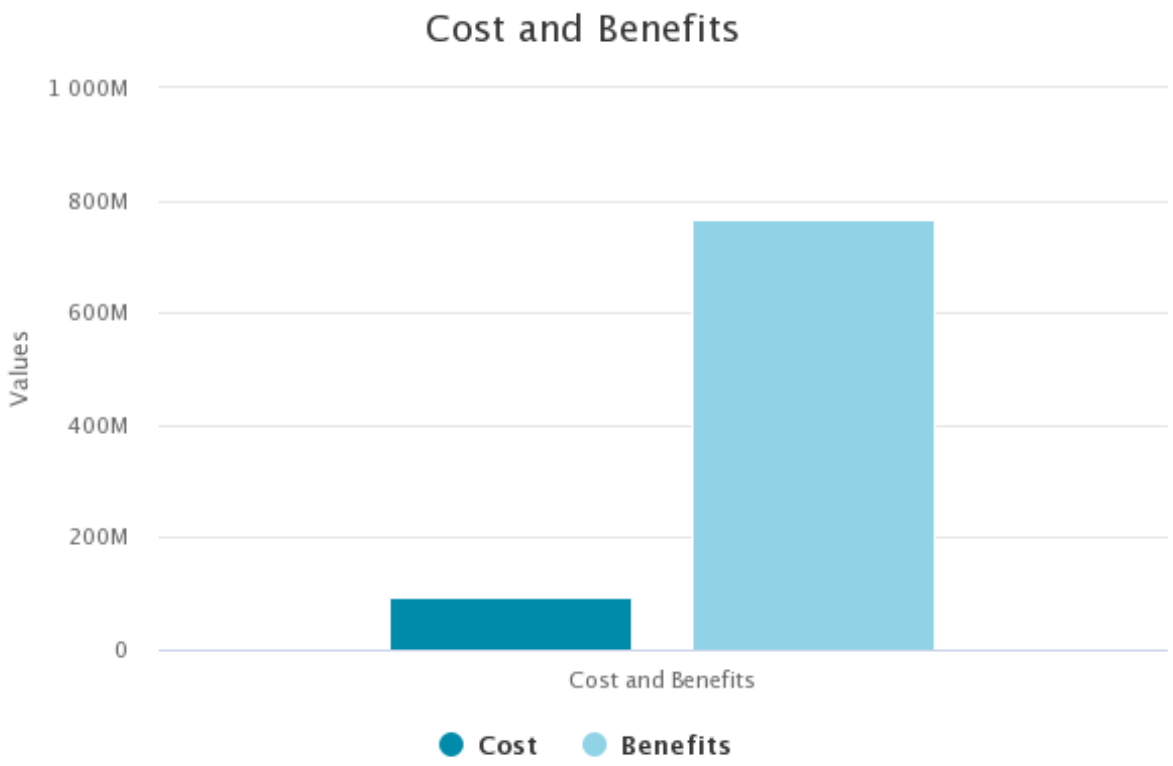


This chart has been built with the data from the following table:

Time period	Total cost	Total discounted cost	Total benefits	Total disc benefits
1.00	15,647,049.24	5,250,010.73	14,901,951.66	5,000,010.22
2.00	41,253,440.34	6,517,078.58	37,418,086.47	5,911,182.39
3.00	52,237,512.70	8,225,208.81	45,124,727.52	7,105,244.63
4.00	52,828,962.94	5,848,031.68	43,462,518.55	4,811,190.14
5.00	52,736,900.47	5,848,031.68	41,320,741.46	4,582,085.85
6.00	52,721,787.54	5,848,031.68	39,341,809.60	4,363,891.28
7.00	52,738,716.80	5,848,031.68	37,480,421.40	4,156,086.94
8.00	52,762,572.27	5,848,031.68	35,711,785.75	3,958,178.03
9.00	52,788,166.42	5,848,031.68	34,027,722.74	3,769,693.37
10.00	52,814,369.52	5,848,031.68	32,423,441.42	3,590,184.16
11.00	52,840,848.13	5,848,031.68	30,894,949.52	3,419,223.01
12.00	52,867,375.78	5,848,031.68	29,438,533.04	3,256,402.86
13.00	52,893,916.78	5,848,031.68	28,050,773.39	3,101,336.06
14.00	52,920,471.99	5,848,031.68	26,728,434.46	2,953,653.39
15.00	52,946,951.63	5,848,031.68	25,468,389.03	2,813,003.23
16.00	52,973,383.63	5,848,031.68	24,267,717.40	2,679,050.70
17.00	52,999,800.13	5,848,031.68	23,123,637.24	2,551,476.85
18.00	53,026,127.59	5,848,031.68	22,033,451.26	2,429,977.96
19.00	53,052,401.63	5,848,031.68	20,994,636.83	2,314,264.72
20.00	53,078,658.13	5,848,031.68	20,004,788.01	2,204,061.64
21.00	53,104,825.97	5,848,031.68	19,061,571.81	2,099,106.32
22.00	53,130,941.54	5,848,031.68	18,162,805.52	1,999,148.88
23.00	53,157,040.97	5,848,031.68	17,306,407.24	1,903,951.31
24.00	53,183,053.80	5,848,031.68	16,490,358.35	1,813,286.96
25.00	53,209,016.26	5,848,031.68	15,712,769.98	1,726,939.97
26.00	53,234,964.32	5,848,031.68	14,971,840.49	1,644,704.73
27.00	53,260,827.93	5,848,031.68	14,265,823.23	1,566,385.46
28.00	53,286,643.08	5,848,031.68	13,593,083.60	1,491,795.67
29.00	53,312,445.53	5,848,031.68	12,952,062.51	1,420,757.78
30.00	53,338,165.57	5,848,031.68	12,341,248.66	1,353,102.65

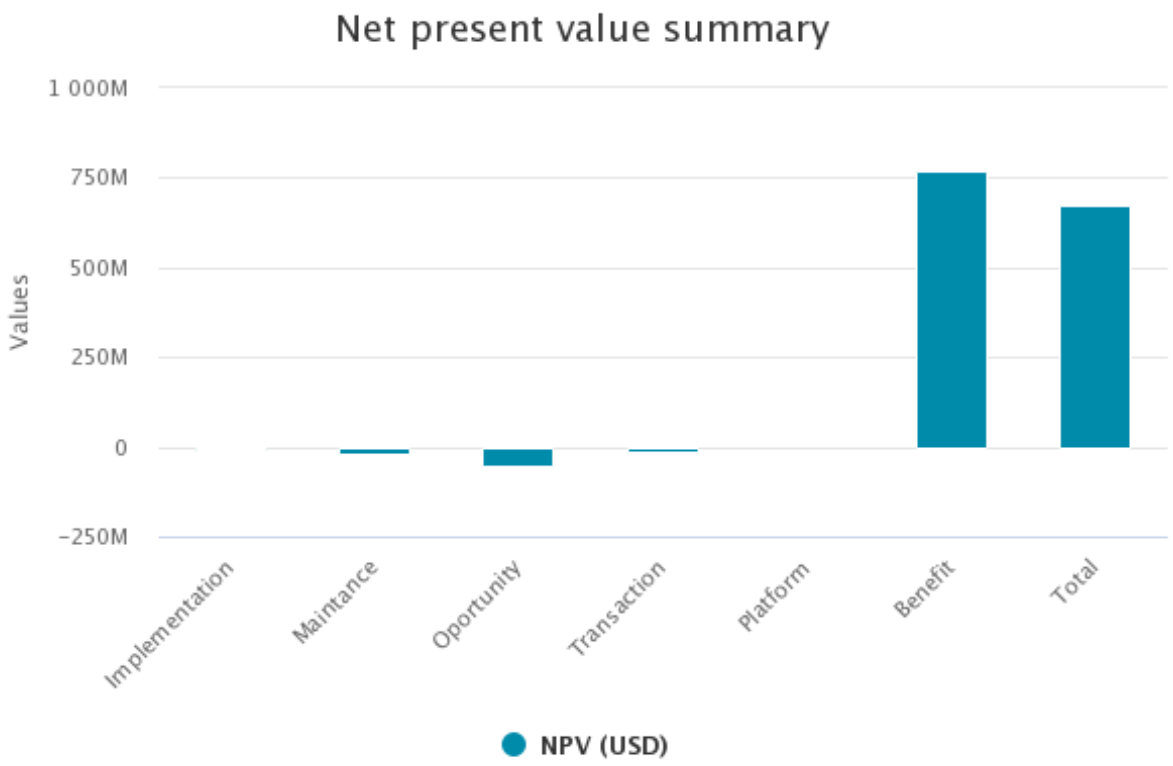
Comparative chart of costs and benefits:

This graph allows you to compare your investment in the implementation and maintenance of the selected NbS, with respect to the economic benefits, which are obtained from the savings in the maintenance of the water intakes systems and casa study infrastructure



Comparative chart of costs and benefits:

Cost	91,989,377.16
Benefits	767,076,488.14

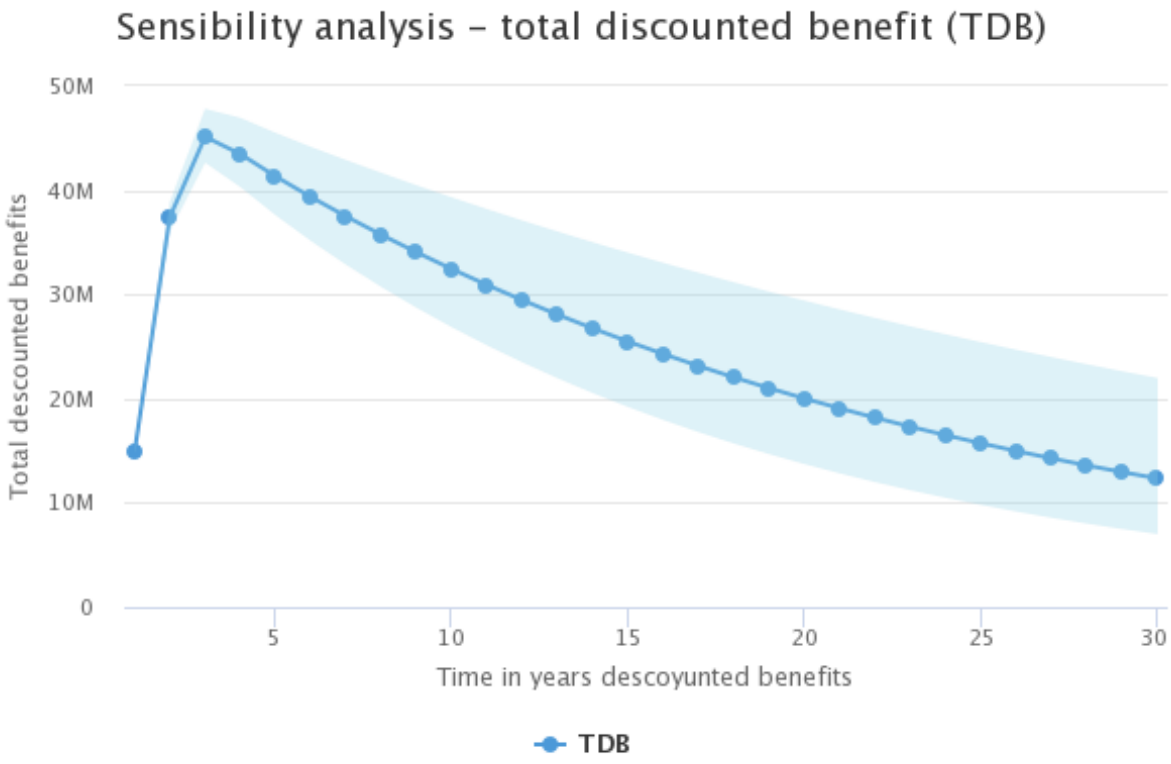


In the graph you can see i) each type of cost NPV, ii) benefits NPV and iii) total NPV which is the difference between costs and benefits

Net present value sumary	
Implementation cost: cost requiere to implement the activities including materials, supplies and labor	-5,744,751.93
Maintance cost: costo to manintain NBS	-16,767,542.80
Oportunity cost: foregone benefits that would have been derived from and option another than NBS	-50,938,953.62
Transaction cost: refers to administrative expenses	-14,690,249.67
Platform cost: these are fored expenses for the conservation program, shich include staff, office, equipment, vehicles, among others.	-3,847,879.14
Benefit	767,076,488.14
Total	675,087,110.99

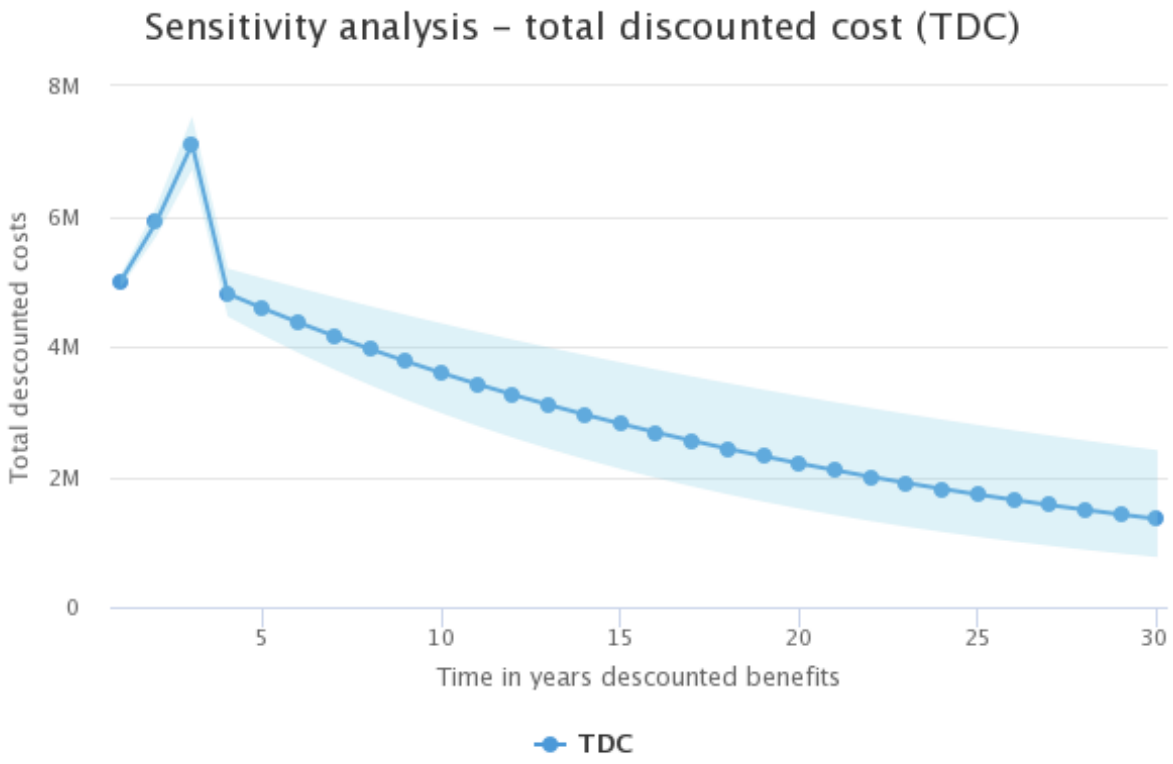
Sensitivity analysis

Next, a simple sensitivity analysis is presented through the variation of the discount rate under the defined lower and upper limits. Remember that the discount rate is the cost of capital that is applied to determine the present value of a future payment.



This graph is constructed with the data from the following table:

Total discounted benefit	Discounted benefit minimum	Discounted benefit medium	Discounted benefit maximum
1.00	15,191,309.94	14,901,951.66	14,623,410.51
2.00	38,885,324.10	37,418,086.47	36,032,352.46
3.00	47,804,724.05	45,124,727.52	42,641,370.71
4.00	46,937,849.32	43,462,518.55	40,302,962.88
5.00	45,491,313.61	41,320,741.46	37,600,681.19
6.00	44,153,667.05	39,341,809.60	35,130,753.15
7.00	42,881,402.95	37,480,421.40	32,843,022.27
8.00	41,651,261.78	35,711,785.75	30,708,297.44
9.00	40,457,734.01	34,027,722.74	28,713,264.92
10.00	39,298,850.98	32,423,441.42	26,848,147.36
11.00	38,173,352.96	30,894,949.52	25,104,306.30
12.00	37,080,113.69	29,438,533.04	23,473,747.10
13.00	36,018,183.51	28,050,773.39	21,949,094.97
14.00	34,986,666.33	26,728,434.46	20,523,471.44
15.00	33,984,633.48	25,468,389.03	19,190,411.87
16.00	33,011,261.34	24,267,717.40	17,943,917.80
17.00	32,065,750.71	23,123,637.24	16,778,379.42
18.00	31,147,261.41	22,033,451.26	15,688,517.78
19.00	30,255,043.34	20,994,636.83	14,669,431.14
20.00	29,388,366.07	20,004,788.01	13,716,533.90
21.00	28,546,460.75	19,061,571.81	12,825,510.44
22.00	27,728,639.96	18,162,805.52	11,992,352.98
23.00	26,934,234.03	17,306,407.24	11,213,312.12
24.00	26,162,538.36	16,490,358.35	10,484,859.29
25.00	25,412,922.50	15,712,769.98	9,803,717.48
26.00	24,684,772.27	14,971,840.49	9,166,820.93
27.00	23,977,441.83	14,265,823.23	8,571,284.60
28.00	23,290,352.95	13,593,083.60	8,014,429.01
29.00	22,622,942.33	12,952,062.51	7,493,747.44
30.00	21,974,617.99	12,341,248.66	7,006,881.04



This graph is constructed with the data from the following table:

Total discounted cost	Discounted cost minimum	Discounted cost medium	Discounted cost maximum
1.00	5,097,097.80	5,000,010.22	4,906,552.09
2.00	6,142,971.61	5,911,182.39	5,692,268.83
3.00	7,527,231.24	7,105,244.63	6,714,220.49
4.00	5,195,900.41	4,811,190.14	4,461,435.37
5.00	5,044,563.50	4,582,085.85	4,169,565.77
6.00	4,897,634.47	4,363,891.28	3,896,790.44
7.00	4,754,984.92	4,156,086.94	3,641,860.22
8.00	4,616,490.21	3,958,178.03	3,403,607.68
9.00	4,482,029.33	3,769,693.37	3,180,941.76
10.00	4,351,484.79	3,590,184.16	2,972,842.77
11.00	4,224,742.52	3,419,223.01	2,778,357.73
12.00	4,101,691.76	3,256,402.86	2,596,596.01
13.00	3,982,225.01	3,101,336.06	2,426,725.24
14.00	3,866,237.88	2,953,653.39	2,267,967.51
15.00	3,753,629.01	2,813,003.23	2,119,595.81
16.00	3,644,300.01	2,679,050.70	1,980,930.66
17.00	3,538,155.35	2,551,476.85	1,851,337.07
18.00	3,435,102.28	2,429,977.96	1,730,221.56
19.00	3,335,050.75	2,314,264.72	1,617,029.49
20.00	3,237,913.35	2,204,061.64	1,511,242.52
21.00	3,143,605.20	2,099,106.32	1,412,376.18
22.00	3,052,043.88	1,999,148.88	1,319,977.74
23.00	2,963,149.40	1,903,951.31	1,233,624.06
24.00	2,876,844.08	1,813,286.96	1,152,919.68
25.00	2,793,052.50	1,726,939.97	1,077,495.03
26.00	2,711,701.46	1,644,704.73	1,007,004.70
27.00	2,632,719.86	1,566,385.46	941,125.89
28.00	2,556,038.70	1,491,795.67	879,556.90
29.00	2,481,590.97	1,420,757.78	822,015.80
30.00	2,409,311.62	1,353,102.65	768,239.06

Return on investment calculation

Canculated ROI

8.34

ROI on nature based solutions opportunity

Very high

Total estimated investment

767,076,488.14

Total treatment cost savings

91,989,377.16

Total area investment size

2,057.55

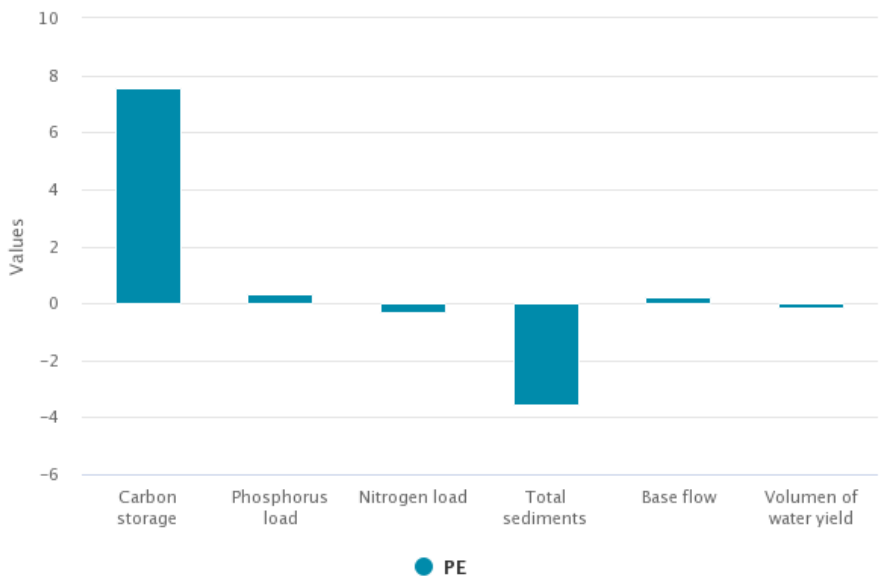
Time frame (Years)

30.00

Estimated change in ecosustem services by basin

Total analysis

Indicador	Value
Change in volume of water yield (%)	-0.15%
Change in base flow (%)	0.21%
Change in total sediments (%)	-3.53%
Change in nitrogen load (%)	-0.33%
Change in carbon storage (%)	7.58%



Change in volume of water yield: Do changes in landscape affect the annual average water yield? Note that the model helps to establish changes in the annual water yield by analyzing the Bussiness as Usual (BaU) scenario and the Nature based Solutions scenario

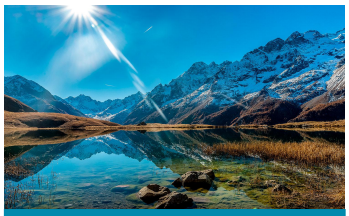
Change in base flow: Do landscape changes affect the basin runoff and recharge? The value presented depends on the cponnectivity and land use and cover components, so that the recharge is influenced by variables sich as vegetation cover and connectivity.

Change in total sediments: Do you see changes in the amount od sediments yield from in tge basin? significant changes will result in erosion and water quality impacts.

Change in total Nitrogen - Cah ge in total Phosphorous: Do you notice significant changes in the load of these nutrients? With this analysis you can assess the nutrient retention service by natural vegetation. It also allows you to identify potential treatment cost or improve water safety through access to clean water

Change in Carbon storage: Are you seeing change in carbon storage? Carbon storage in a land parcel (pixel) depends n four carbon pools: aboveground biomass, underground biomass, soil and dead organic matter.

Intake_1_Tester_27-08-2021



Physical risk quantity

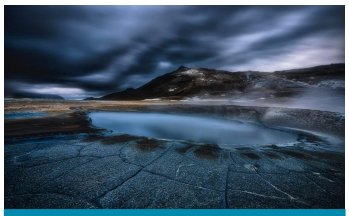
Physical risk quantity measures risk related to too little or too much water by aggregating all selected indicators from the physical risk quantity category

MEDIUM HIGH

Physical risk quality

Physical risk quantity measures risk related to water that in unfit for use by aggregating all selected indicators from the physical risk quantity category

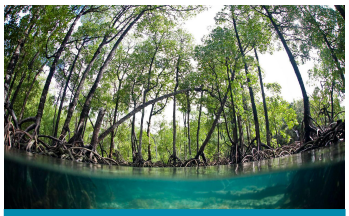
LOW



Regulatory and reputational

Risk regulatory and reputational risk measures risk related to uncertainty in regulatory chance, as well as conflich with re public regarding water issues

MEDIUM LOW

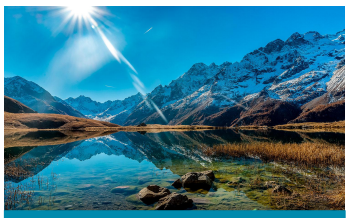


Overall water risk score

Overall water risk measures all water related risk, by aggregating all selected indicators from the physical risjk quantity, physical risk quality, and regulatory and reputational risk categories

MEDIUM LOW

Intake_2_Tester_27-08-2021



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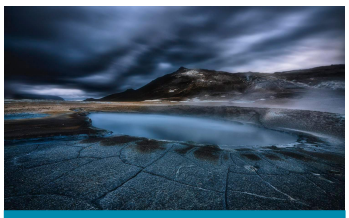
Physical risk quantity measures risk related to water that in unfit for use by aggregating all selected indicators from the physical risk quantity category

LOW



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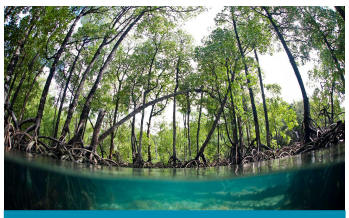
MEDIUM LOW



Overall water risk score

Overall water risk measures all water related risk, by aggregating all selected indicators from the physical risjk quantity, physical risk quality, and regulatory and reputational risk categories

MEDIUM LOW

Estimated change in ecosystem services (BaU vs NbS)

Anual water yield	Seasonal water yield	Sediment delivery ratio	Nutrient delivery ratio - nitrogen	Nutrient delivery ratio - phosphorus	Carbon storage and sequestration
					
-0.02	0.35	-5.12	-0.44	0.08	10.26

Intervention and budget summary

Intake_1_Tester_27-08-2021

Nature based Solution	Actual spend	Area converted (Ha)
00001_conservacion-del-bosque-tester-alpha-v3	1,520,481.42	490.35
00002_restauracion-pasiva-tester-alpha-v3	477,013.78	153.84
00003_restauracion-activa-enriquecimiento-tester-alpha-v3	115,453.70	19.23
00004_agroforesteria-tester-alpha-v3	1,478,611.19	548.04
00004_sistemas-silvopastoriles-tester-alpha-v3	169,526.96	38.46

Intake_2_Tester_27-08-2021

Nature based Solution	Actual spend	Area converted (Ha)
00001_conservacion-del-bosque-tester-alpha-v3	1,520,481.42	490.35
00002_restauracion-pasiva-tester-alpha-v3	1,431,041.34	461.51
00003_restauracion-activa-enriquecimiento-tester-alpha-v3	1,385,444.43	230.75
00004_agroforesteria-tester-alpha-v3	1,478,611.19	548.04
00004_sistemas-silvopastoriles-tester-alpha-v3	1,398,597.39	317.29

Physical indicators

Intake_1_Tester_27-08-2021

Indicator	Sigla	Description	Value
Future 10 years	F_10_UT	Demanda de Agua	3
	F_10_SV	Variabilidad Estacional	2
	F_10_WS	Estrés hídrico	1
	F_10_BT	Suministro de Agua	4

Intake_2_Tester_27-08-2021

Indicator	Sigla	Description	Value
Future 10 years	F_10_UT	Demanda de Agua	3
	F_10_BT	Suministro de Agua	4
	F_10_WS	Estrés hídrico	1
	F_10_SV	Variabilidad Estacional	2

Intake_1_Tester_27-08-2021

Indicator	Sigla	Description	Value
Future 20 years	F_20_BT	Suministro de Agua	4
	F_20_WS	Estrés hídrico	1
	F_20_SV	Variabilidad Estacional	2
	F_20_UT	Demanda de Agua	3

Intake_2_Tester_27-08-2021

Indicator	Sigla	Description	Value
Future 20 years	F_20_WS	Estrés hídrico	1
	F_20_UT	Demanda de Agua	3
	F_20_BT	Suministro de Agua	4
	F_20_SV	Variabilidad Estacional	2

Intake_1_Tester_27-08-2021

Indicator	Sigla	Description	Value
Physical Risk associated with Amount of Water	H_BWS	Baseline water stress	1
	H_CFR	Drought risk	1
	H_RFR	Riverine flood risk	2
	H_GTD	Groundwater table decline	1
	H_SEV	Seasonal variability	1
	H_IAV	Interannual variability	2
	H_BWD	Baseline water depletion	1

Baseline water stress measures the ratio of total water withdrawals to available renewable surface and groundwater supplies. Higher values indicate more competition between users.

Baseline water depletion measures the total water consumption of available renewable water supplies. Higher values indicate a greater impact on the local water supply and decreased water availability for downstream users.

Interannual variability measures the average between-year variability of available water supply, including both renewable surface and groundwater supplies. Highervalues indicate wider variations in available supply from year to year.

Seasonal variability measures the average within-year variability of available water supply, including renewable surface and ground water supplies. Higher valuesindicate wider variations in the supply available within a year.

Water table decline measures the average water table decline as the average change for the study period (1990-2014). The result is expressed in centimeters per year (cm / year). Higher values indicate higher levels of unsustainable groundwater.

River flood risk measures the percentage of the population expected to be affected by river flooding in an average year, taking into account existing flood protection standards. Higher values indicate that, on average, a greater proportion of the population is expected to be affected by river flooding.

Intake_2_Tester_27-08-2021

Indicator	Sigla	Description	Value
Physical Risk associated with Amount of Water	H_RFR	Riverine flood risk	2
	H_SEV	Seasonal variability	1
	H_GTD	Groundwater table decline	1
	H_CFR	Drought risk	1
	H_BWD	Baseline water depletion	1
	H_BWS	Baseline water stress	1
	H_IAV	Interannual variability	2

Baseline water stress measures the ratio of total water withdrawals to available renewable surface and groundwater supplies. Higher values indicate more competition between users.

Baseline water depletion measures the total water consumption of available renewable water supplies. Higher values indicate a greater impact on the local water supply and decreased water availability for downstream users.

Interannual variability measures the average between-year variability of available water supply, including both renewable surface and groundwater supplies. Highervalues indicate wider variations in available supply from year to year.

Seasonal variability measures the average within-year variability of available water supply, including renewable surface and ground water supplies. Higher valuesindicate wider variations in the supply available within a year.

Water table decline measures the average water table decline as the average change for the study period (1990-2014). The result is expressed in centimeters per year (cm / year). Higher values indicate higher levels of unsustainable groundwater.

River flood risk measures the percentage of the population expected to be affected by river flooding in an average year, taking into account existing flood protection standards. Higher values indicate that, on average, a greater proportion of the population is expected to be affected by river flooding.

Intake_1_Tester_27-08-2021

Indicator	Sigla	Description	Value
Physical risk quantity	H_DRR	Aguas Residuales Conectadas sin Tratar	2

Untreated connected wastewater measures the percentage of domestic wastewater that is connected through a sewer system and is not treated to at least a primary treatment level. Discharging wastewater without adequate treatment could expose water bodies, the general public, and ecosystems to pollutants such as pathogens and nutrients. Higher values indicate higher percentages of point source wastewater discharged without treatment.

Intake_2_Tester_27-08-2021

Indicator	Sigla	Description	Value
Physical risk quantity	H_DRR	Aguas Residuales Conectadas sin Tratar	2

Untreated connected wastewater measures the percentage of domestic wastewater that is connected through a sewer system and is not treated to at least a primary treatment level. Discharging wastewater without adequate treatment could expose water bodies, the general public, and ecosystems to pollutants such as pathogens and nutrients. Higher values indicate higher percentages of point source wastewater discharged without treatment.

Intake_1_Tester_27-08-2021

Indicator	Sigla	Description	Value
Regulatory and reputational	H_UDW	Riesgo Pico RepRisk Country ESG	4
	H_UCW	Sin Mejorar / Sin Agua Potable	3
	H_CEP	Sin Mejorar / Sin Saneamiento	1

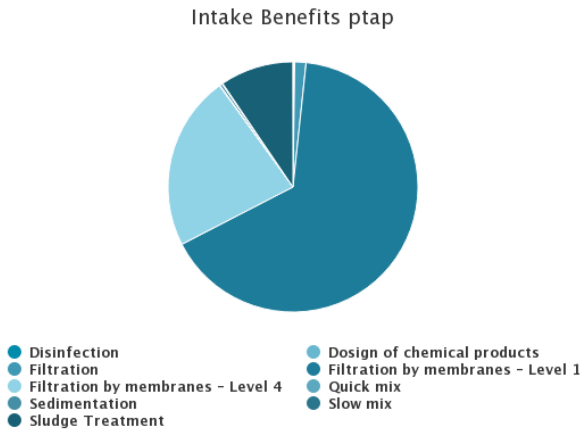
Unimproved / no drinking water reflects the percentage of the population that collects drinking water from an unprotected dug well or spring, or directly from a river, dam, lake, pond, stream, canal or irrigation canal (WHO and UNICEF 2017). Higher values indicate areas where people have less access to clean water supplies.

Intake_2_Tester_27-08-2021

Indicator	Sigla	Description	Value
Regulatory and reputational	H_CEP	Sin Mejorar / Sin Saneamiento	1
	H_UDW	Riesgo Pico RepRisk Country ESG	4
	H_UCW	Sin Mejorar / Sin Agua Potable	3

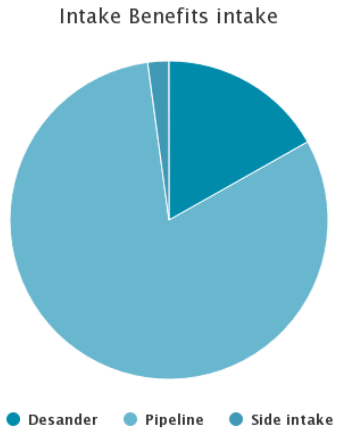
Unimproved / no drinking water reflects the percentage of the population that collects drinking water from an unprotected dug well or spring, or directly from a river, dam, lake, pond, stream, canal or irrigation canal (WHO and UNICEF 2017). Higher values indicate areas where people have less access to clean water supplies.

Decision indicators



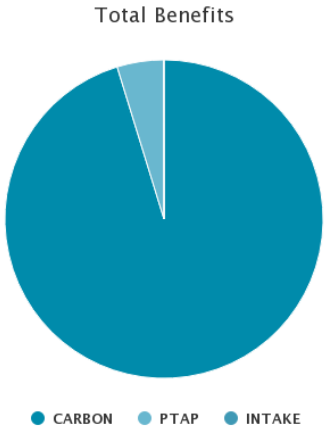
Disinfection	32,383.79
Dosign of chemical products	42,500.31
Filtration	521,304.52
Filtration by membranes - Level 1	23,169,104.57
Filtration by membranes - Level 4	7,954,517.29
Quick mix	31,735.65
Sedimentation	106,117.18
Slow mix	39,849.49
Sludge Treatment	3,345,777.38

Identify the elements that will yield the most benefits



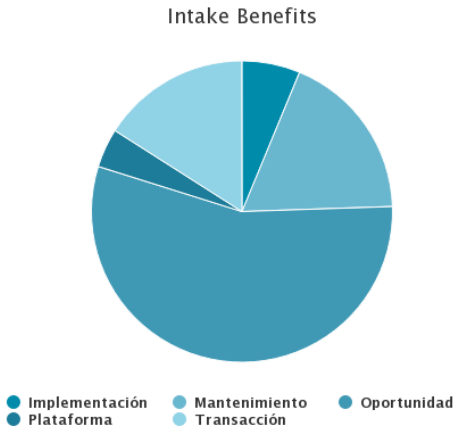
Desander	14,755.33
Pipeline	70,987.71
Side intake	1,874.37

Identify the elements that will yield the most benefits



CARBON	708,657,486.66
PTAP	35,243,290.11
INTAKE	87,617.41

This is a disaggregated view of the benefits by elements



Implementación	5,744,751.93
Mantenimiento	16,767,542.80
Oportunidad	50,938,953.62
Plataforma	3,847,879.14
Transacción	14,690,249.67

In this graph you can identify the magnitudes of the costs, in order to help identify where greater investments are needed

00001_Conservacion del Bosque (Tester Alp	29,781,424.28
00002_Restauracion Pasiva (Tester Alpha V	18,987,364.50

Identify the proportion of costs for each of the activities of your interest

Geographic resources

The analysis run includes geographic outputs that you can consult at the following link

Intake_1_Tester_27-08-2021

http://apps.skaphe.com:8000/reports/compare-maps/?folder=1000_469_2021-8-27&intake=481&region=SA_1&year=3&study_case_id=469&center=1.94,-76.4

Intake_2_Tester_27-08-2021

http://apps.skaphe.com:8000/reports/compare-maps/?folder=1000_469_2021-8-27&intake=481&region=SA_1&year=3&study_case_id=469&center=1.94,-76.4