D2.9 - Roadmap for full-scale implementation of SWS at Maneadero Valley, Mexico

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Executive Summary

Water resources management is a major challenge in Baja California where all sectors are being affected by the drought. Stakeholders are in need for alternative solutions and are open to innovations such as SWS. However, the implementation and adaptation of these solutions is challenged by the (local)political environment, the compliance with the regulations and the social acceptance among others.

To assure a successful implementation of the SWS system, the following challenges must be overcome:

Social acceptance

The main challenge identified for the implementation of the project is the social acceptance to the use of reclaimed water. Agriculture in Maneadero mainly consists of high value crops for exportation. This is a very competitive market and its sanitary regulations are highly strict.
If recovered source proves to have sufficient quality for irrigation, the farmers see the technology as a workable solution for their water supply and particularly favour the limited footprint and smaller investment requirements compared to desalinated water and its needed intensive infrastructure.

Legal framework

The legal framework allowing the use of treated wastewater for aquifer recharge (NOM014-CONAGUA) is very strict. Recharge is only allowed if the treated water fulfills the (chemical) characteristics of drinking water quality. Two permits are necessary to start the pilot. One for drilling and constructing the pilot (monitoring) wells and one for extracting and using the water. This makes the permitting process time consuming, uncertain and complicated. It is therefore recommended to start the permitting process for a full scale set up as soon as the first results of the field pilot are available. Early start of the permitting application will keep stakeholders engaged as they will know that the next step is waiting for the governmental decision and this will take time.

Collaboration among parties

As observed during the design process and the pilot implementation, stakeholders show themselves very enthusiastic and cooperative during the planning meetings. However, when the time to take action arrives, they seem to forget the agreements that have been made and start questioning the process and the distribution of tasks again. Making the steps to an implementation and the responsibilities and obligations attached to that to become unclear and slow down the process. This was already encountered during the process of setting up the monitoring campaign of the field pilot. Assumed commitments in the information gathering process and the drafting/execution of the sampling campaign, needed to be doubly confirmed written down to ensure everybody agreed on the same tasks and (financial) obligations.

Good alignment between parties is core for the implementation of the system and ensuring the next steps will be implemented. A clear and detailed agreement on cooperation and commitment levels between different actors, strongly focusing on their financial obligations and possibilities, is required previous to the implementation of the system.

importance of a constant and timely information flow, to keep the relationships warm and stakeholders (future users) enthusiastic and committed.

The communication strategy as part of the road map to the full-scale implementation of SWS will be strongly based on the results of the field pilot. These results will prove to the future users that the needed water quality can be achieved through SWS. Supported by the updated models to show that the freshwater volumes will become available when SWS will be implemented on full scale.

Financial options and ownership of the system

Another challenge is the funding of the systems. Stakeholders are very interested in the solution but are not willing to invest in something that hasn't been proof to work. After the results of the pilot are gathered, better strategies to divulgate the actual results achieved could help in gaining engagement and future funding possibilities.

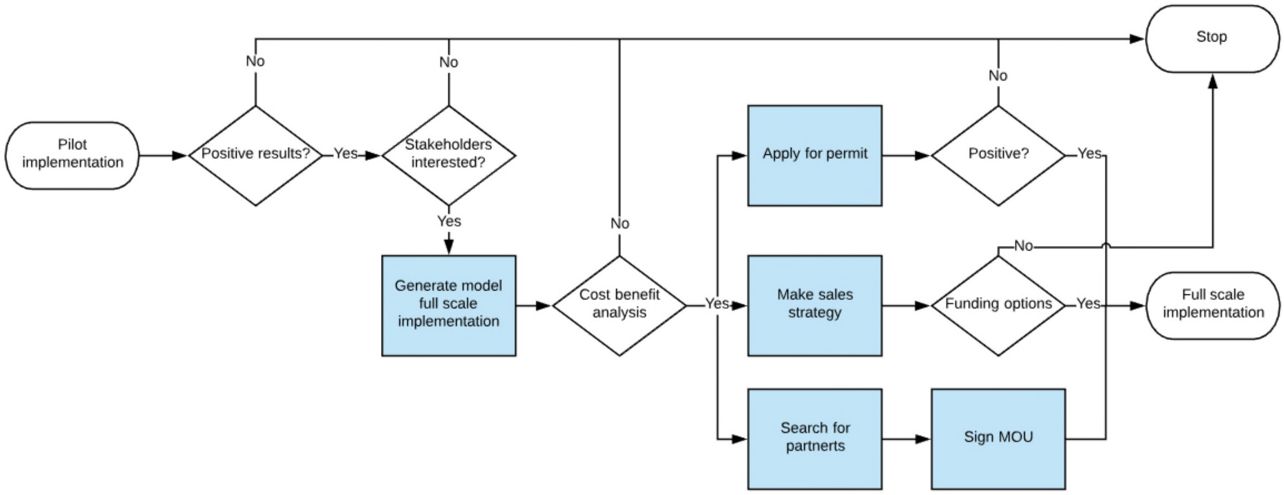
Regarding the ownership of the field pilot system; the ideal candidates to manage the pilot seem to be the Ejido, CESPE and UABC. However, in the past, conflicts have arisen regarding fees and investment costs required for the connection of a farmland to the pipe system from Ensenada for reuse of treated wastewater. The same conflicts are expected if no clear definition is made regarding the distribution of the exploitation costs and benefits of the "new water source". The creation of a consortium seems to be the most feasible model to solve for the financial and operational problems.

Key success factors for the current field pilot to grow to a full-scale system are:

- Effective communication campaign. Addressing a constant flow of information and (realistic) expectations management. Information must be technically grounded and preferably shared making use of illustrations;
- A solid stakeholder management strategy that assures the early and constant engagement to the process. Using the current communication lines of local farmers organizations, (local) authorities and knowledge centers (UABC, CICESE) as base;
- A phased approach with intermediate results based on built in go/no-go moments and providing realistic results managing expectations;
- Water quality analyses to underline towards the end users the appropriate quality of the water recovered. Even when you can expect it will be of a high quality (e.g. with respect to viruses, pesticides, bacteria), the end users need to see this confirmed by results produced by unbiased and acknowledged parties;

- If possible, use external innovation budget and/or external assistance to move forward towards a full-scale installation;
- Know the risks and how to cope with them.

Once the SWS pilot is in operation, regular monitoring and reporting of the performance of the system and the achieved water quality is important to maintain the confidence in the provided solution. The results of the cost benefit analysis also support the development of a new "sales strategy" to search for further funding options. The above-mentioned process has been summarized In the diagram below.



Conclusion

Coming from an addressed need for a solution to overcome an imbalance on available freshwater in a saline groundwater environment to a full operating SWS system takes both communication as well as technical skills. Using reclaimed water as a possible water source to positively influence the local fresh water balance is technical feasible but will encounter strong social barriers to become accepted. It is necessary to follow parallel path both researching the possibilities on geohydrology and geology as well as social acceptance. Information flowing parallelly will help smoothing the implementation process. It is essential to engage local partners, with knowledge on these subjects as well as a strong positive image to the stakeholders involved.

The full implementation period will take over two years at least to come to a full-scale system.

1. Introduction

Subsurface Water Solutions (SWS) offer an innovative, robust and practical solution to protect, enlarge and assure availability of water all year round. Allowing in this way a proper groundwater management and better control over freshwater resources.

Water resources management is a major challenge in Baja California where all sectors are being affected by the drought. Stakeholders are in need for alternative solutions and are open to innovations such as SWS. However, the implementation and adaptation of these solutions is challenged by the (local)political environment, the compliance with the regulations and the social acceptance among others.

The creation of a strategy that is locally adapted increases the interest towards these solutions and enhances their acceptance. This report will address the roadmap for the implementation of SWS in Maneadero, Mexico focusing on the key aspects to achieve success and the main challenges that have been detected.

Furthermore, based on the market scans that have been executed in surrounding regions, a general approach for analyzing replication areas in Mexico is also drafted in this report.

2. Lessons learned from stakeholder meetings

Subsurface Water Solutions are capable of addressing all water management issues of Baja California, they are low-cost and low-tech, and they fit the local institutional capacity. The hydrogeological modeling study indicated that the installation of a combination of an infiltration pond (already present) and a brackish water abstraction well (to promote infiltration) as a potential viable and effective solution that would further increase the sustainability of the area (D2.7 Feasibility study and pilot design for Maneadero Valley, Mexico). However, the implementation success is largely dependent on the adaptation to the local environment and the acceptance from the (local) stakeholders towards this solution.

Stakeholders realize that they are in need for alternative solutions and are open to innovations as SWS. However, due to the lack of understanding of the system and the uncertainty on the water quality that can be recovered, they hesitate towards the implementation of the system. Their most usual questions are:

- Will the quality of the recovered water be sufficient for irrigation?
- Will there be mixing with the saline aquifer?
- Will there be chemical alteration to the native water?
- Will there be too strong buoyancy effects which can reduce the recoverability?
- Will the products irrigated with this water be accepted for exportation purposes?
- Will the availability of fresh groundwater increase?
- Will there be any health risks?

The stakeholders are skeptical but remain positive and interested in the solution and ask for more concrete information about the future project. The presented technical model doesn't seem technically founded as no concrete numbers were presented. Also, a clear comparison of cost, quality, environmental impacts and advantages of SWS implementation against other technologies is required.

A constant and solid dialogue with all stakeholders and authorities prior to decision making and implementation is core to assure a smoother process with local support and cooperation, and a solution that is adjusted to local needs and resources. Furthermore, a communication- and action plan is essential. The crucial factors to address, as voted by the stakeholders, are 'acceptation of products irrigated with this water', 'security of supply', 'cost' and 'impact on aboveground function'.

Despite the similitude in the stakeholder's responses, small variances in the main interest per sector are observed as follows.

Agriculture: main interest is assuring that the recovered water won't have any quality issues that can affect to the crops exportation value or acceptance

Authorities: assuring that the water quality complies with the regulation

Organizations: demonstrate that the technique doesn't damage the environment

Local residents: securing a constant supply that will incentive the economy in the area

3. Summary pilot results

The following results are addressed based on the assumptions of the model setup and anticipated on the results of the field pilot as comparison to the existing conditions.

Existing soil layers

Maneadero aquifer as set up in the model is relatively thick and highly permeable and seems to lack confining (or less conductive) clay layers. This is a disadvantageous for realization of an effective combined infiltration and brackish water abstraction: a substantial proportion of the brackish water that is abstracted, originates from deeper down in the aquifer and therefore it is hard to lower the hydraulic head below the pond to promote transport of freshwater to deeper parts of the aquifer. During the drilling activities, as part of the field pilot, a better insight of the (local) geology will be obtained. Drilling activities will start beginning of August 2018. They will provide the needed insight on the build-up of the soil through lithological columns. This will also make it possible to formulate conclusions over the differences and implications over the expected efficiency of the used model and will result in a better and improved model.

Water quality

a) Salinity distributions

The model considered salinity distributions as derived from regional studies and model calibration as summarized in Table 1.

Table 1 Coordinates, filter depth and TDS measured in the infiltration pond and surrounding wells

Well	Longitude N	Latitude E	Depth filter m-surf	Year TDS measurement	TDS Ppm
M36	3509759.24	536636.83	60	2016	17000
M16/157	3506211.479	537744.916	48	2011	16000
161	3509818	537324	25	2011	25600
P1	3509863	536910	12	2017	3820
Pond	3509872	536939	2.5	2016	2100
Pond	3509872	536939	2.5	2014	2653
Pond	3509872	536939	2.5	2014	2776

During the pilot, the real salinity distributions will be measured from which a complete profile can be derived. After completion of the well, measurements will take place in the second half of August 2018.

b) Water quality of reclaimed water

As observed in Table 2 Observed hydrogeochemical parameters in reclaimed water (Gilabert et al, 2018)), the TDS concentration is considerably higher than the maximum specified by the NOM127-SSA (1,000mg/L). Given that the soil passage doesn't remove the salinity (main cause for TDS), it can be assumed that for the full-scale implementation, additional measurement will be required to reduce this parameter. For example, the use of a brackish water RO system. The use of a RO-system as part of the real life operational SWS set up is implemented at different replication sites in the Netherlands.

Table 2 Observed hydrogeochemical parameters in reclaimed water (Gilabert et al, 2018)[1].

Sampling locations A: St Carlos Creek, B&D: Las Animas Creek, C: infiltration pond (field pilot location)

Parameter	Unit	Reclaimed water			
		A: nov-15	B: apr-16	C: aug-17	D: aug-17
pH		7	7.2	6.8	7.6
EC	(µS/cm)	4885	3982	4,671	4432
TDS	(mg/L)	3017	2691	2886	3663
Temperature	(°C)	27.7	24.2	26.9	22.4
Hardness	(CaCO3 mg/L)	889	1057	915	870
Na^+	(mg/L)	440	437	536	491
K^+	(mg/L)	23	27	25	21
Ca^{2+}	(mg/L)	215	255	223	210
Mg^{2+}	(mg/L)	86	102	87	84
Cl^-	(mg/L)	1005	1282	1084	981
HCO^{3-}	(mg/L)	270	398	401	448
CO_3^{2-}	(mg/L)	133	196	197	220

[1] Gilabert, C., Daessle, L., Salgado, S., Perez-Flores, M. et al. 2018. Effects of reclaimed water discharge in the Maneadero coastal aquifer, Baja California, Mexico. Elsevier. https://doi.org/10.1016/j.apgeochem.2018.03.006

SO_4^{2-}		219	296	240	217
NO_3^{-}-N	(mg/L)		3		
Br^{-}	(mg/L)	2	2.3	2.3	2.1
B^{-}	(µg/L)		878		
$PO_4{}^{3-}$P	(µg/L)		5140		

The presented water quality of the reclaimed water is relatively constant over the year that leads to the conclusion that the water treatment facility operates at a constant efficiency.

c) Achieved treatment through soil passage

One of the main challenges identified for (large scale) use of reclaimed water in Maneadero Valley is the social acceptance and the farmers' concerns about pathogens that will be present in the reclaimed water thus the assurance of microbiological safe irrigation water. Aquifers are well capable of removing pathogens and other potentially hazardous substances. Rule of thumb is a residence time/soil passage time of the infiltrated water between 60 to 90 days for this removing capability to show.

Infiltration rates

The infiltration rate was simulated and optimized using model calibration of river conductance. Through the field pilot installation, the infiltration rates will be observed constantly. Monitoring reports on flow, water quality data (table 2) and concentration of pathogens will be drafted periodically. The local partners, UABC and CICESE, will perform the observations of the field pilot and maintain the monitoring wells under supervision of the local authority COTAS. UABC will monitor the biochemical and chemical composition of the infiltrated water and CICESE will monitor the physical effects of the infiltrated water. They will continue this work in support of the road to a full scale set up.

4. Challenges

To assure a successful implementation of the SWS system, the following challenges must be overcome:

Social acceptance

The main challenge identified for the implementation of the project is the social acceptance to the use of reclaimed water. Agriculture in Maneadero mainly consists of high value crops for export. This is a very competitive market and its sanitary regulations are highly strict. Therefore, farmers are concerned about the pathogens that might be present in the reclaimed water and their possible affectations to their crops value. Also, there's a high uncertainty feeling on the acceptance of this new agriculture procedure by the vegetable importers. If recovered source proves to have sufficient quality for irrigation, the farmers see the technology as a workable solution for their water supply and particularly favour the limited footprint and smaller investment requirements compared to desalinated water and its needed intensive infrastructure.

Legal framework

The legal framework allowing the use of treated wastewater for aquifer recharge (NOM014-CONAGUA) is very strict. Recharge is only allowed if the treated water fulfills the (chemical) characteristics of drinking water quality. The implementation of SWS systems requires careful treatment of reclaimed water and continuous documentation and monitoring of the water quality. As will be observed from the field pilot results. Currently TDS levels (mainly caused by salinity concentrations) are above the parameters accepted by the law. Additional measurements, as the installation of a RO system, must be considered to be used as a pretreatment step.

Furthermore, due to the possible risks to the environment, the permit application for full scale implementation is expected to take a longer processing time. As soon as the first results of the field pilot are available, it is advised to start the permitting process. Early start of the permitting application will keep stakeholders engaged as they will know that the next step is waiting for the governmental decision and this will take time.

Collaboration among parties

As observed during the design process and the pilot implementation, stakeholders show themselves very enthusiastic and cooperative during the planning meetings. However, when the time to take action arrives, they seem to forget the agreements that have been made and start questioning the process and the distribution of tasks again. Making the steps to an implementation and the responsibilities and obligations attached to that to become unclear and slow down the process. This was already encountered during the process of setting up the monitoring campaign of the field pilot. Assumed commitments in the information gathering process and the drafting/execution of the sampling campaign, needed to be doubly confirmed written down to ensure everybody agreed on the same tasks and (financial) obligations.

Good alignment between parties is core for the implementation of the system and ensuring the next steps will be implemented. A clear and detailed agreement on cooperation and commitment levels between different actors, strongly focusing on their financial obligations and possibilities, is required previous to the implementation of the system.

Another factor that largely influences the commitment level to the project is the communication fluency. During the pilot implementation it was observed that the long periods without communication had a negative impact on the image of the project and led to an uncertainty feeling towards the project team (SubSol) and its supporters (Universities UABC and CICESE). This shows the importance of a constant and timely information flow, to keep the relationships warm and stakeholders (future users) enthusiastic and committed.

Furthermore, it is important to keep the main stakeholders interested and informed of the main activities of the project as they can help to enforce certain actions through their power stakes and relations.

The communication strategy as part of the road map to the full-scale implementation of SWS will be strongly based on the results of the field pilot. These results will prove to the future users that the needed water quality can be achieved through SWS. Supported by the updated models to show that the freshwater volumes will become available when SWS will be implemented on full scale. This needs to connect to the questions shown in chapter 2 for bringing this to a successful (supported) implementation.

Financial options and ownership of the system

Another challenge is the funding of the systems. Stakeholders are very interested in the solution but are not willing to invest in something that hasn’t been proof to work. After the results of the pilot are gathered, better strategies to divulgate the actual results achieved could help in gaining engagement and future funding possibilities. The opportunity to ‘scale-up’ a well field in time is interesting. A spread investment (instead of a full investment upfront) enhances the possibilities of acquiring funding from private parties and through governmental instruments. This also gives the opportunity to gain more knowledge on the water demand and the operational conditions of the system which translate to higher selling points.

During the interviews with the local farmers, it was observed that the implementation of Reverse Osmosis systems is largely being favored by the authorities. The existence of subsidies for equipment and electricity costs make this an attractive option. This comes as a result of (national) authorities being aware of the urgency of the issue, but not of all the alternatives available to address them (e.g. SWS).

Regarding the ownership of the field pilot system; the ideal candidates to manage the pilot seem to be the Ejido, CESPE and UABC. However, in the past, conflicts have arisen regarding fees and investment costs required for the connection of a farmland to the pipe system from Ensenada for reuse of treated wastewater. The same conflicts are expected if no clear definition is made regarding the distribution of the exploitation costs and benefits of the “new water source”. The creation of a consortium seems to be the most feasible model to solve for the financial and operational problems.

5. Keys to success

Key success factors for the current field pilot to grow to a full-scale system are:

- Effective communication campaign. Addressing a constant flow of information and (realistic) expectations management. Information must be technically grounded and preferably shared making use of illustrations;
- A solid stakeholder management strategy that assures the early and constant engagement to the process. Using the current communication lines of local farmers organizations, (local) authorities and knowledge centers (UABC, CICESE) as base;
- A phased approach with intermediate results based on built in go/no-go moments and providing realistic results managing expectations;
- Water quality analyses to underline towards the end users the appropriate quality of the water recovered. Even when you can expect it will be of a high quality (e.g. with respect to viruses, pesticides, bacteria), the end users need to see this confirmed by results produced by unbiased and acknowledged parties;
- If possible, use external innovation budget and/or external assistance to move forward towards a full-scale installation;
- Know the risks and how to cope with them.

6. Roadmap

Full implementation of SWS in Maneadero Site

Once an SWS pilot is in operation, regular monitoring and reporting of the performance of the system and the achieved water quality is important to maintain the confidence in the provided solution, especially by policy makers and regulaters.

The current field pilot permit states that the pilot needs to be active for at least six months to monitor the results of the extraction, infiltration and water quality in the area surrounding the infiltration pond (field pilot location). This is a natural moment to evaluate the field pilot results and share the first results with governmental organizations and local community. Six month is not a very long time for natural processes. To come to a strong supportive conclusion it is necessary to run the pilot for at least one year to have a general idea on the climate interaction and seasonal influences on the processes. Once this first year has finished the planning of the process to come to a full-scale implementation site starts. If after this period positive results are observed, and stakeholders are still interested in scaling-up the solution, the permit application process for the full scale SWS can start. During the time it takes to process the application and come to a decision the monitoring activities will continue. The obtained results can be further analyzed and used for developing a more detailed hydrogeological model and a model for a full-scale implementation. The outcomes of the hydrogeological model can be translated into a cost benefit analysis. Positive outcomes of the hydrogeological model and the cost-benefit analysis will be shared during the permit application process and helps to (re)gain confidence from current partners and opens the possibility to gain new partners. As observed before, at all times a clear MOU has to be maintained to assure a smooth collaboration among parties.

The results of the cost benefit analysis also support the development of a new “sales strategy” to search for further funding options. Until now, the pilot installation has been implemented with financial support of SubSol. For the full-scale implementation, financial support must also be given by the farmers and state or local institutions. This generates further engagement into the project and assures that the community will embrace the system and will remain it in good operational conditions.

The above-mentioned process has been summarized in Image 1.

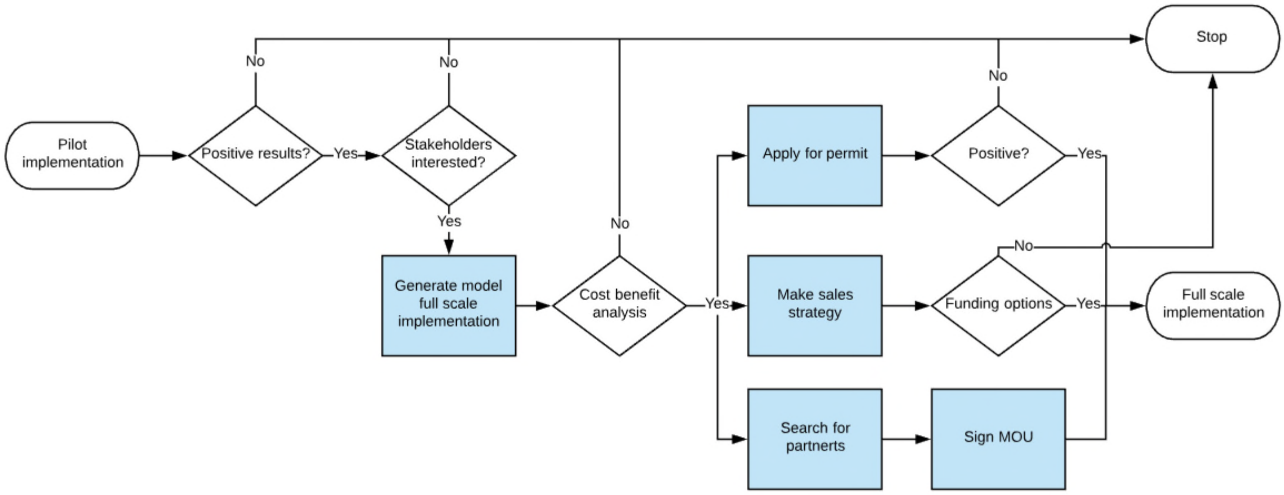


Image 1 Schematized approach for full-scale implementation of SWS in Maneadero

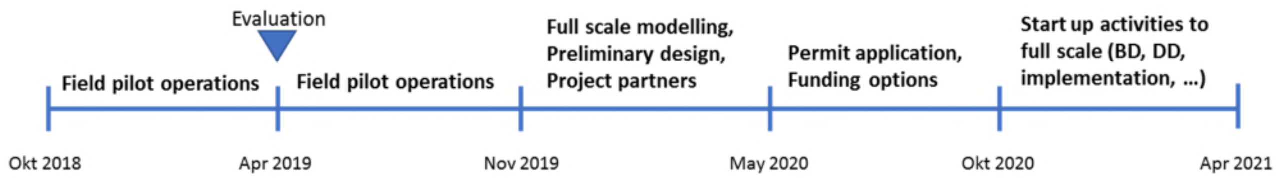


Image 2 Expected timeline for full-scale implementation of SWS in Maneadero

Replication sites

With the help of the insights gained during the visits to possible replication sites in Mexico, a general approach for new SWS projects in Mexico has been drafted as observed in Image 3.

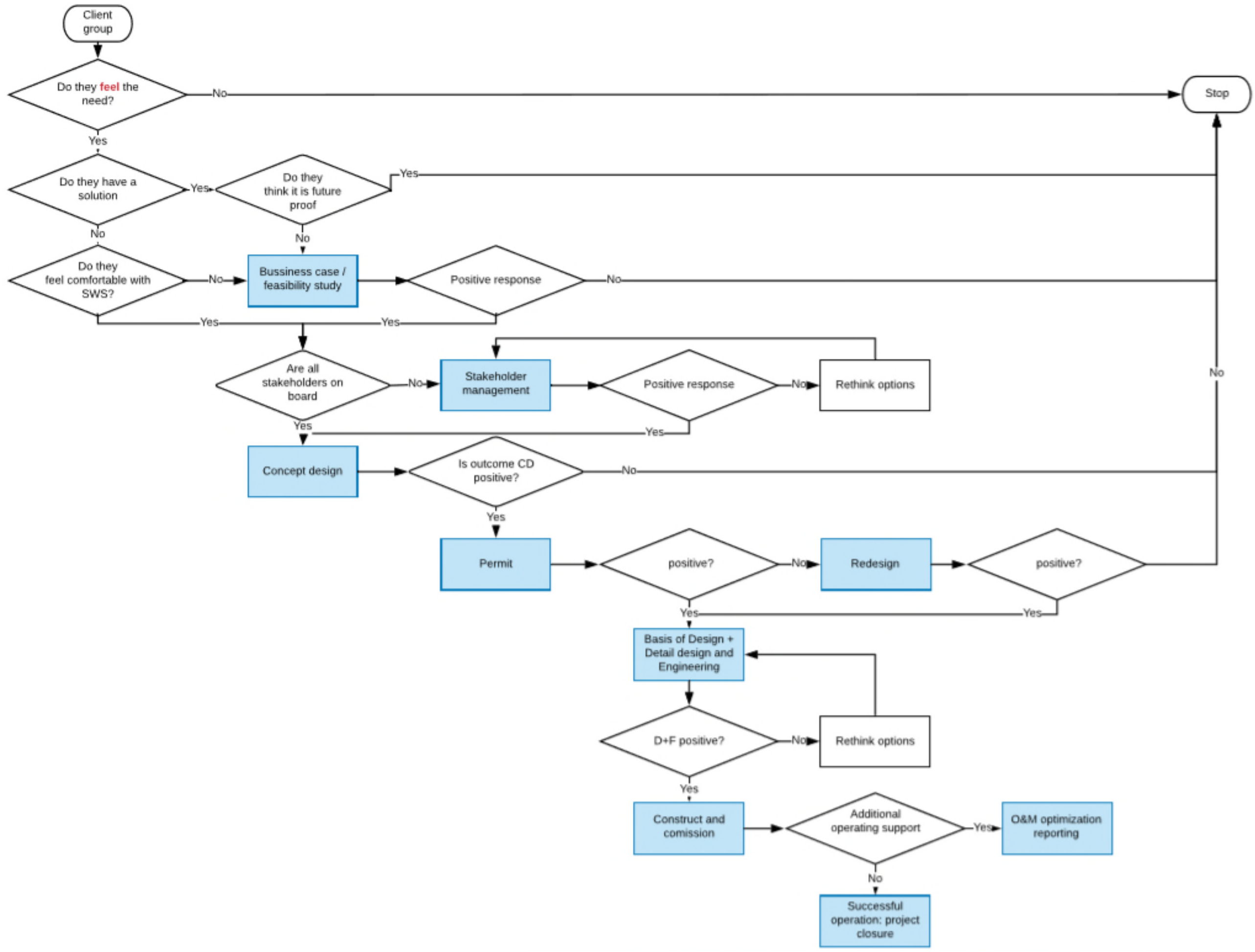


Image 3 Schematized approach from start to finish of new SWS projects

These steps can be also approached as follows:

1. **Identify the problem and stakeholders**

Before any approach is done, a desk research must be performed to gain insights of the current situation of the study area. The main points to identify are:

- the origins and severity of the (fresh water) problem;
- the status of the available water resources;
- the status of the available water infrastructure;
- the main stakeholders.

By mapping of the involved stakeholders, a better image can be obtained regarding the different sort of stakeholders, their power (decision makers, enablers...), their relationships and interests. From this information, a first approach of the unique buying reasons of the system can be drafted as exemplified in Table 3.

Table 3 Draft of unique buying reasons from agricultures

Incentive	Agriculture
Unique buying reasons	• Securing Return on Investment via eliminating production limitation risks due to water shortages; • Autonomy of production via guaranteeing availability of fresh water for production; • Affordable and circular water supply solutions; • Comply with water quality and quantity impact regulations.

Once a good picture is created of the current situation, it is important to contact international and Mexican organizations in order to deepen the acquired knowledge and gather further information. At this point it is also important to assess the available technical knowledge, capabilities and capacity. The relevant information to gather is mainly composed by the geology and (geo)hydrological conditions of the area. Soft information are also key factors to detail the unique buying reasons of the system. This information considers their regards to environmental matters, their interest in sustainability and their openness to innovative technologies.

Finally, using the gathered information, a water balance of the area can be drafted to understand current water use, the major water users and to assess the availability of possible infiltration sources. A water balance also helps to quantify the gap between water use, water need and water availability that needs to come to a balance.

2. **Make strategic alliances**

Knowing all the stakeholders in the area and ensuring early involvement in the process is an advantage towards the later engagement of possible users. Stakeholders have good knowledge of the area and all projects that are being performed there. They also possess good relations in diverse groups of society, which facilitates the arrangement of meetings and speeds up the achievement of goals. Furthermore, stakeholders like scientific researchers are well recognized in the area and have credibility from the general audience.

In the case of Baja California, the stakeholders from the possible replication sites are looking for a freshwater solution and did not require further awareness raising. However, making the stakeholders feel comfortable with the concept of SWS can require a lot of time and effort. The strength for this lies within repeating the message, listening to the audience and subsequent follow-up.

3. **Find an early-adopter**

Promotional activities play a key role in creating awareness and finding early adopters of the system. These activities are usually performed as workshops where the SWS concepts are presented in an accessible and uncomplicated way to allow participation and discussion making among the interested stakeholders. During the workshops the following topics are approached:

- verification of the problem;
- inform the stakeholders (present);
- introduce SWS to a broader audience;
- discuss feasibility of SWS implementation;
- cover existing knowledge gaps.

The main aim of the workshops is to enable the dialogue between distinct kinds of stakeholders (farmers, authorities, NGO's…) and gain insights about their main concerns and the criteria that the system must live up to, as expected water quality, costs, environmental concerns et cetera. The participation of diverse stakeholders provides valuable input on how to improve, enhance and manage the effect of the technology in a given setting. This process is also important to draft a clear view of possible investors, owners, operators and even opponents of the system. Furthermore, the workshop helps to stimulate the stakeholders' interest in SWS to jointly identify and outline ideas for potential SWS projects and enhance commitment.

Some positive outcomes observed in different workshops are:

- Bringing key stakeholders together and mobilized them to commit to the process
- Facilitate a positive attitude towards the project among local stakeholders
- Result in land owners welcoming pilot drilling activities on their land
- Paved the way for the permit for the pilot studies
- Illuminated conflicts of interest and hence identified key issues that require further dialogue or process

4. **Perform a business case study**

Once the first hurdle of introducing SWS, followed by creating awareness and finding an early adopter are taken, a hydrological model can be developed to make a location-based evaluation of the suitability and possible outcomes of the system.

In this step the potential of SWS systems to reduce the current pressure on groundwater, and the tangible economic benefits, such as cost savings compared to other solutions like Reverse Osmosis are evaluated.

Quantifying the impacts from the drought and the salinization of wells shows that the project will address several problems from varies angles such as agricultural, social, economic and sustainable. Understanding and analyzing the advantages and challenges for implementation and performing a case-specific risk assessment are also important components of this stage. Furthermore, this analysis must include an assessment of the involved regulatory framework and the required activities to comply with it.

The outcomes of this analysis will help convince others and give early-adopters confidence. Capacity building and creating an enabling environment for the early adopters is an important aspect which needs to be continuously addressed during this stage. Based on experience, the timeframe required to raise awareness, identify early adopters, and get a business case study going for innovative techniques typically takes at least one year.

5. **Perform a pilot installation**

The results of the pilot help proving that the system does not only work on paper and allows a better analysis of the actual operational capacity of the system, without having to invest substantial amounts of resources.

The key issues to be addressed in the pilot include obtaining a better insight in the (local) hydrogeology and geology, more details information on the salinity close to pilot site, an assessment and improvement of the infiltration rates, and of the chemical and microbiological water quality changes during infiltration and aquifer passage.

In this stage the continuous monitoring, documentation and communication of the water quality may be important in order to build trust among users, key customers of agricultural products and authorities. This will require some level of capacity building of the research and scientific monitoring resources in the replication area at hand.

6. **Full-scale installation**

The last step is to come to a design of the full-scale system. This system will be based on the improved models, the pilot monitoring results and the need for freshwater of the stakeholders related to the area at hand.

7. Conclusion

Coming from an addressed need for a solution to overcome an imbalance on available freshwater in a saline groundwater environment to a full operating SWS system takes both communication as well as technical skills. Using reclaimed water as a possible water source to positively influence the local fresh water balance is technical feasible but will encounter strong social barriers to become accepted. It is necessary to follow parallel path both researching the possibilities on geohydrology and geology as well as social acceptance. Information flowing parallelly will help smoothing the implementation process. It is essential to engage local partners, with knowledge on these subjects as well as a strong positive image to the stakeholders involved.

The full implementation period will take over two years at least to come to a full-scale system.