Understanding the Paso Robles Groundwater Basin Crisis

A Senior Project

presented to

the Faculty of the Agriculture Education and Communications Department

California Polytechnic State University, San Luis Obispo

In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Agricultural Science

by

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Abstract

This project provides an informational handbook that explains the Paso Robles groundwater basin crisis. The handbook is intended to be used as an educational tool in raising awareness and explaining the problems with the current Paso Robles groundwater basin situation. The document is straightforward, easy-to-read, and explains the situation from the beginning until the present (February 2014).

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Chapter One

Introduction

The Paso Robles groundwater basin is an invaluable resource that drives the economy of the Paso Robles area. However, in recent years the pumping of groundwater has increased dramatically to the point where the long-term health of the basin is being threatened. As a result, the San Luis Obispo County Board of Supervisors approved of the Urgency Ordinance (Ordinance 3246) which attempts to prevent the situation from deterring further. As a permanent, long-term solution is being developed, it is important to raise awareness of this water crisis in order to spark involvement from more community members.

Statement of the Problem

Awareness of the Paso Robles groundwater basin situation needs to be raised in San Luis Obispo County. While the declining groundwater basin water level directly affects those who reside above the basin, it indirectly affects all individuals in San Luis Obispo County. The wineries and vineyards above the basin alone are a major driving factor in the economy of the entire county. Since the declining groundwater levels in the basin pose a huge threat to the production agriculture of the area, the loss of revenues from wineries and vineyards could have a vast effect on all the residents of San Luis Obispo County. Therefore, the entire county should be aware of the issue in order to get involved in finding a solution to this crisis. However, the issue has many sides and there is such a large amount of information on the subject that some residents may feel overwhelmed when trying to understand the present situation.

Importance of the Project

The project will provide residents of San Luis Obispo County with a handbook that can bring them up-to-speed on the issue. The handbook will be comprehensive and un-biased towards the possible solutions. Moreover, the handbook will be simple and straight-forward. This project is important because community members must be informed on the issue in order to join the discussion about implementing a solution. This handbook will attempt to combine information from multiple sources and present that information in an interesting and easy-to-understand manner. In addition, the handbook will follow the plot of this issue from the beginning to present day while explaining some of the factors that have led to the current crisis.

Purpose of the Project

The purpose of this project is to develop a comprehensive informational handbook that will inform a San Luis Obispo County resident on the current Paso Robles groundwater basin crisis.

Objectives of the Project

1. To create an informative handbook that effectively covers all necessary information regarding the current Paso Robles groundwater basin situation
    a. Conduct thorough research on the Paso Robles groundwater basin crisis
    b. Draft the text portion of the document
    c. Format the document to be visually appealing and professional (through effective use of maps, tables, and graphs).

Definitions of Important Terms:

1. Aquifer: “an underground layer of rock, sediment or soil that is filled or saturated with water” (Ventura River County Water District Glossary of Terms, 2014).
2. Basin: “a groundwater reservoir defined by the overlying land surface and underlying aquifers that contain water stored in the reservoir” (Ventura River County Water District Glossary of Terms, 2014).
3. Groundwater: “water underground, such as in wells, springs and aquifers” (Ventura River County Water District Glossary of Terms, 2014).
4. Hydrology: “the scientific study of the behavior of water in the atmosphere, on the Earth, surface and underground” (Ventura River County Water District Glossary of Terms, 2014).
5. Land Subsidence: “is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials” (USGS science for a changing world, 2014).
6. Perennial Yield: “maximum quantity of water that can be annually withdrawn from a groundwater basin over a long period of time (during which water supply conditions approximate average conditions) without developing an overdraft condition” (Ventura River County Water District Glossary of Terms, 2014).
7. Surface-water: “natural water that has not penetrated much below the surface of the ground” (Merriam Webster, 2014).
8. Transpiration: “the passage of watery vapor from a living body (as of a plant) through a membrane or pores” (Merriam Webster, 2014).

9. Vested Rights: “a right belonging so absolutely, completely, and unconditionally to a person that it cannot be defeated by the act of any private person and that is entitled to governmental protection usu. under a constitutional guarantee” (Merriam Webster, 2014).

Summary

Overall, this project should be used as a hand-out resource to be given to members of the public that wish to be informed on the Paso Robles groundwater basin crisis. The development of this handbook will provide San Luis Obispo residents with an easy-access resource to educate themselves on the current Paso Robles groundwater basin situation.

Chapter Two

Review of Literature

This chapter will supply background information on groundwater and groundwater resource management. Before understanding the specifics of the Paso Robles groundwater basin, it may be useful to have some background knowledge on the subject of groundwater. This chapter will explain some roles that groundwater plays in the water cycle as well as describe some key challenges in managing groundwater resources.

Importance of Groundwater

Groundwater is one of the most import natural resources in the world. Excluding the water locked in the polar ice caps, approximately 95% of all the freshwater on Earth is stored below the Earth's surface as groundwater (Adams et al.). Groundwater is the source of drinking water for roughly half of the United States' population, and the "Total ground-water pumping in the Nation was nearly 80 billion gallons per day in 1995" (Galloway et al.). The other major source of freshwater is surface-water. Groundwater moves through aquifers from areas of recharge to areas of discharge, whereas surface water is found in streams, rivers, and lakes. These two sources of freshwater differ greatly and have different hydrological characteristics. For example groundwater resources tent to have very large storage capacities while surface water resources tend to hold only small to moderate volumes of water (Tuinhof et al.). "In the four decades up to the early 1980's an estimated 500 square-km of groundwater, an equivalent to more than three times the total volume of either Lake Kariba or Lake Nasser, was withdrawn from the Ogalalla aquifer that underlies portions of eight states in central USA" (Adams et al.).

In addition to having large storage volumes, groundwater is often drought resistant and experiences low and localized amounts of evaporation loss. However, one challenge in monitoring groundwater resources is defining the flow boundaries of an aquifer. Since the resource is underground, there is not a clearly visible border for groundwater basins like there is for surface water reservoirs. When trying to manage these "invisible" water resources, it is important to have an understanding of the basic properties and processes of groundwater movement.

Groundwater in the Hydrological Cycle

The hydrological cycle, also known as the water cycle, describes the movement of water on, above, and below the Earth's surface. Groundwater is a very important part of this cycle and is explained in chapter two of "Groundwater and its Susceptibility to Degradation. The explanation starts with the precipitation portion of the water cycle. Part of the rainfall infiltrates into the soil while the rest runs off into streams or other bodies of surface water. Of the portion that enters the soil, some is used by plants and then lost through transpiration and the rest sinks further into the soil and accumulates above an impermeable layer. When the water collects above an impermeable bed it begins to saturate all the soil's pore space above the bed and begins to form an underground reservoir. When these underground reservoirs grow to the point that they can store and transport groundwater they are termed aquifers. The top of the underground reservoir is called the water table. The water table reaches the surface at most rivers and surface water reservoirs that are fed by groundwater.

"The productivity of an aquifer depends on its ability to store and transmit water, and these qualities may vary" (Adams et al.). For example, the productivity of an aquifer in a sandy

soil will differ from the productivity of an aquifer in a clay based soil. Sandy soils contain much more pore space than soils that are heavy in clay, and water is stored in the pore space of a soil. Therefore, the larger the amount of pore space in a water-saturated soil, the larger the volume of water that is stored in that soil. In highly consolidated rocks, groundwater is found only in fractures that generally only hold a small amount of water. However, those fractures provide the predominant flow-path for that groundwater. Large aquifers that combine the storage capacity of porous soil with the flow-path of fractures are known as dual permeability aquifers (Adams et al.). After the water accumulates in these underground reservoirs, it continues moving through the hydrological cycle by returning to the surface. The water often returns to the surface by being discharged into a stream or surface water reservoir or by being pumped to the surface via a well. The water (now surface water) continues its cycle where it will eventually make its way back underground.

Groundwater Resource Management

Groundwater resource management is a very case-dependent process. Each groundwater aquifer will be in a unique soil, with unique boundaries and users, and have many other characteristics that are unique to that particular region. It is therefore impossible to develop a general plan that will effectively manage any groundwater resources. Groundwater basins may be used for production agricultural, urban development, environmental purposes, or a combination of many purposes. In addition to the fact that groundwater aquifers are very complex resources, there are many other key challenges for groundwater resource management. Firstly, "Calls for groundwater management do not usually arise until a decline in well yields and/or quality affects one of the stakeholder groups" (Tuinhof et al.). When this becomes the

case, there is more pressure and stress in developing a management strategy because the health of the resource that is in use is being threatened. Also, "It is essential to recognize that managing groundwater is as much about managing people (water and land users) as it is about managing water (aquifer resources)" (Tuinhof et al.). Groundwater management practices will need to be debated and agreed upon by all the major stakeholders in each particular situation. This can be a major challenge when there are many categories of stakeholders in a single situation. For example, the Paso Robles groundwater basin supplies water to rural residents, small-scale farms, large-scale vineyards, urban populations, and other groups. It is very important to manage the resource appropriately in order to prevent the undesirable consequences of poor management such as storage depletion, land subsidence, and saltwater intrusion.

Summary

Overall, groundwater is a tremendously important resource. When developing a plan to manage this resource, it is very important to understand hydrological characteristics (size, areas of recharge, areas of discharge, storage volume, flow rates, etc.) of the groundwater reservoir. It is also important to identify all the users of the water resource. The Paso Robles groundwater basin is a large reservoir that supplies water needs to many different categories of users. To make matters more complicated, a management strategy must be devised soon because the health of the basin is being threatened due to the over-pumping of water from the basin.

Chapter Three

Methods and Materials

It is important for residents of San Luis Obispo County to be aware of the issues that the community is facing. In order to quickly inform residents of one of the major issues the county is currently facing, this project was created. The final document (titled "The PR Groundwater Basin") should quickly inform the reader without any supplemental introduction or explanation. The document has three basic parts, and each part required extensive research. First, background information on the Paso Robles groundwater basin was researched. This research included the size, location, pumping volumes, and users of the basin. The second part of the handbook focuses on Ordinance 3246 and the issue of vested rights. Finally, the last part of the handbook explores the long-term solutions to the declining groundwater basin water level. After conducting sufficient research, the informational document was drafted, revised, and finalized.

Research

Before creating the document, extensive research needed to be conducted on the subject. First the Paso Robles groundwater basin itself was researched. A majority of the research conducted on the Paso Robles groundwater basin was found in the resource capacity study adopted by the Board of Supervisors titled "Water Supply in the Paso Robles Groundwater Basin". The document contained important information on the groundwater basin's perennial yield, pumping volumes for past years, and an overall summary of the state of the groundwater basin. Next, research was conducted on Ordinance 3246. Information on the urgency ordinance was found through several articles published in The Tribune as well as reading the piece of

legislation itself. Finally, research was conducted on possible long-term solutions to the crisis. Two groups have become very influential in advocating management strategies for the groundwater basin. Those two groups (PRAAGS and PRO Water Equity) have posted several articles on their websites that outline their plans to protect the health of the basin.

Writing and Formatting the Document

After sufficient research had been conducted, the next step in completing the project was to draft and format the document. In order to make the document more appealing, it was designed to be straight-forward and easy to understand. Several graphics were used (tables, maps, and graphs) to help visual learners better understand the problem. While the majority of the document was creating using Microsoft Word, some of the graphics were developed in Microsoft Excel. After the initial writing of the document, several revisions were made until the final product was completed.

Summary

Overall, the document was developed after thorough research of the groundwater basin situation. The document included sections on several important aspect of the issue. It is intended to be used as a complete guide to educate a previously ignorant individual about the Paso Robles groundwater basin and the problems with the current management of the water resource. In addition it explores possible solutions to the water crisis.

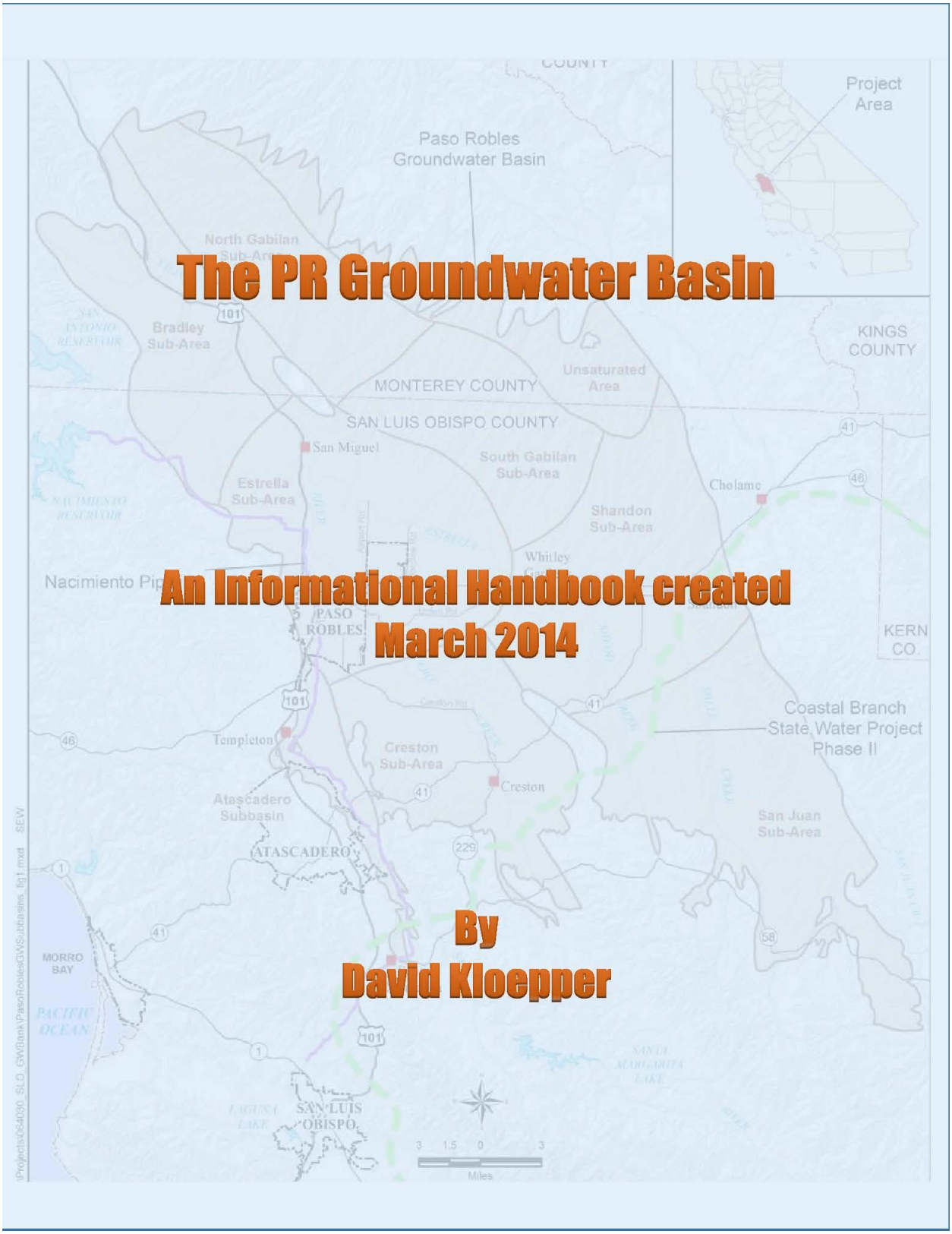
Chapter Four

Results and Discussion

The result of this project is a document titled “The PR Groundwater Basin”. This chapter includes a copy of the finished version of the document. The document is designed to require no introduction; it is meant to be handed to a complete stranger and still be effective in sufficiently educating the individual on the subject.

“The PR Groundwater Basin”

The following is a copy of the document:



The PR Groundwater Basin

An Informational Handbook created March 2014

By David Kloepper

About this Handbook

This handbook was developed for residents of San Luis Obispo County who are unaware or uninformed about the current situation involving the Paso Robles groundwater basin. This handbook is broken into three different parts. The first part of this handbook focuses on the physical characteristics and the users of the Paso Robles groundwater basin. Furthermore, the first part of this handbook explains the consequences of over-pumping water from a groundwater basin. The second part of this handbook explains Ordinance 3246 (a piece of legislation that affects the pumping of water from the basin) and explains the idea of vested rights. The final part of this handbook describes possible management structures for the groundwater basin. Since the groundwater basin fuels a huge part of the San Luis Obispo County economy, it is important for all residents of SLO County to have a good understanding of the situation.

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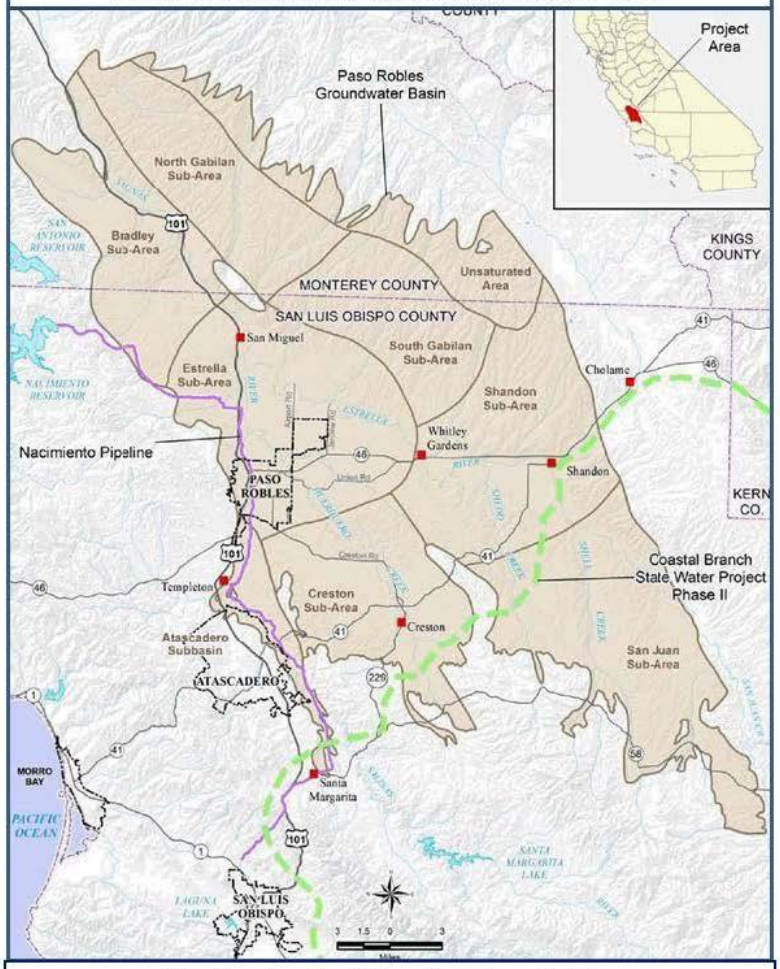
Part One: Background Information

In order to better understand some of the proposed solutions to the groundwater basin crisis, it is first important to have some background knowledge about the Paso Robles groundwater basin. This part of the handbook will explain some of the geography and physical characteristics of the groundwater basin, and it will explain how groundwater pumping has changes over the last decade. The topic of groundwater basin subsidence will also be covered, as it is a result of over pumping groundwater basins.

The Paso Robles Groundwater Basin

The Paso Robles groundwater basin is a massive water resource extending from Atascadero to San Ardo in Monterey County (south to north) and from Shandon to the Highway 101 corridor (east to west). That area totals to be 505,000 acres. In order to better understand the groundwater basin, a resource capacity study was conducted on the water supply in the Paso Robles groundwater basin and adopted by the San Luis Obispo County Board of Supervisors in February of 2011. One important characteristic of groundwater basins is the perennial yield of that groundwater basin. The resource capacity study quoted the Furgo 2002 report to define perennial yield as "the amount of usable water of a groundwater basin that can be withdrawn and consumed economically each year for an indefinite period of time." If a volume larger than the perennial yield is pumped from a groundwater basin, the long-term health of the basin will be threatened and may result in diminished storage capacity. The perennial yield of the groundwater basin was calculated to be 97,700 acre-feet/year (Giffin et al., 2011). Below is a map of the Paso Robles Groundwater Basin.

Figure 1. Map of Paso Robles Groundwater Basin

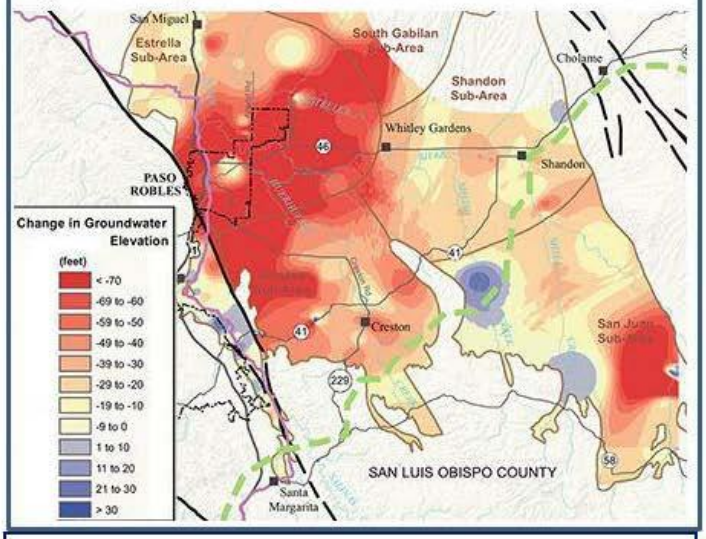


Map Found on Blue Ribbon Committee Website

Over the past decade, pumping volumes of groundwater have increased to the point that the health of the Paso Robles groundwater basin is being threatened. This threat is better visualized in Figure 2 (see next page) that shows how the groundwater levels have changed for

some areas of the groundwater basin. In many places, the groundwater elevation has decreased by an astounding 70 feet (the area shaded red).

Figure 2. Map of Paso Robles Groundwater Levels



Map Found in the article "Water Worries in Paso Wine Country" by Andrew Adams

Groundwater Basin Subsidence

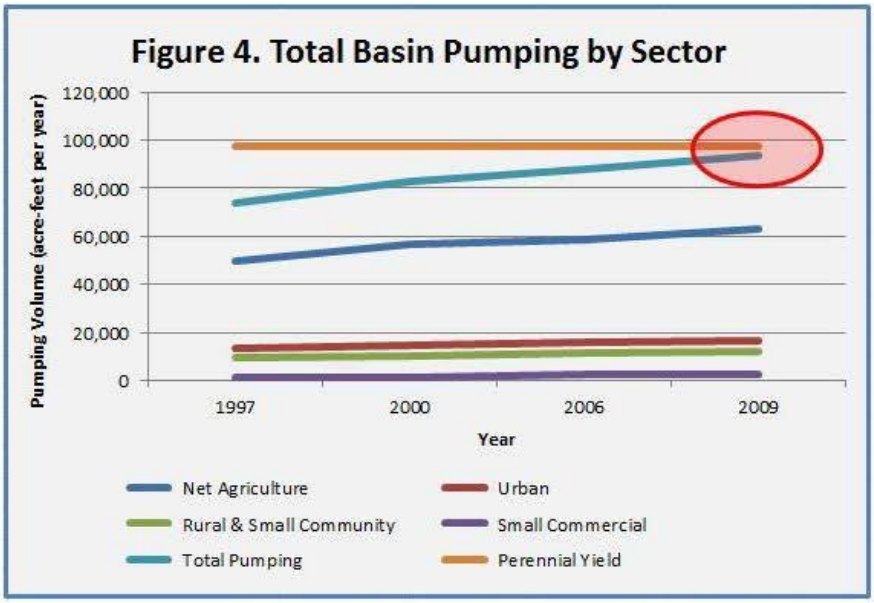
This over-pumping of water from the basin presents a terrifying possibility: land subsidence due to groundwater depletion. Subsidence occurs when pumping volumes exceed the perennial yield of a groundwater basin. "Land subsidence due to groundwater overdraft is essentially irreversible" (Bouwer, 1977). Therefore, once the water storage of the groundwater basin is diminished it cannot be recovered. If land subsidence were to happen to Paso Robles groundwater basin, the economy of that part of the county would suffer greatly. Production agriculture (namely vineyards) and agricultural tourism (namely wineries) are major driving factors in the economy of the Paso Robles area. The wineries and vineyards in the area are also

gaining worldwide recognition after winning the Wine Enthusiast Magazine's 2013 Wine Region of the Year award (Heimoff, 2013). In recent years, pumping volumes have increased dramatically. This is a result of an increase in the populations of cities above the groundwater basin and an increase of production agriculture in the area. Below is a table that contains data on pumping volumes for 1997, 2000, 2006, and 2009.

Figure 3. Table of Groundwater Basin Pumping Volumes

Groundwater User	1997	2000	2006	2009
Net Agriculture	49,683	56,551	58,680	63,077
Urban	13,513	14,629	15,665	16,382
Rural & Small Community	9,400	9,993	11,485	11,817
Small Commercial	1,465	1,465	2,323	2,631
Total	**74,061**	**82,638**	**88,153**	**93,907**

Users of the groundwater basin can be classified into one of four categories: agriculture, urban (municipal users), rural residents (including small community systems), and small commercial systems (such as golf courses and wineries). The increase in pumping volumes is more easily seen in Figure 4 which depicts a line graph of the data in the table above. The red highlighted area in Figure 4 below shows that the total pumping (light blue line) is approaching the perennial yield (orange line) of the groundwater basin.



Summary

The 2010 estimates of the pumping volumes for the basin are 91,838 to 96,723 acre-feet per year (Giffin et al, 2011). That is an astounding 94% to 99% of the perennial yield of the basin. It is quite apparent that if pumping volumes continue to increase then negative consequences (such as land subsidence or saline intrusion) may occur. A major change in the management of the Paso Robles groundwater basin must be devised and implemented swiftly to prevent irreversible damage to the production agriculture operations, the communities in the area, and San Luis Obispo County as a whole.

Part Two: The Urgency Ordinance

This part of the handbook is dedicated to explain the Urgency Ordinance. After first explaining the purpose of Ordinance 3246, this section will then explain some of the exceptions to the ordinance. The body responsible for approving the urgency ordinance is the San Luis Obispo Board of Supervisors. "The San Luis Obispo Board of Supervisors, the legislative arm of the County government, is committed to the implementation of such policies and the provision of such services that will enhance the economic, environmental and social quality of life in San Luis Obispo County" (Board of Supervisors Mission Statement).

Ordinance 3246

Since the situation in North County has become so dire, the Board of Supervisors approved Ordinance 3246 (the Urgency Ordinance) for 45 days on August 27, 2013. On October 8, 2013, the Board of Supervisors extended the Urgency Ordinance for the maximum two years (until August 27, 2015). The ordinance is a ten page document that is broken down into ten different sections. The first three pages of the document are dedicated to section one which is titled "Findings and Declarations". The section explains the dire situation of the basin, physical characteristics, and other findings the County has discovered through studies such as the Resource Capacity Study (Similar to what is described in part one of this handbook). Section two of the ordinance simply asserts that the ordinance applies to all properties that overlie the Paso Robles groundwater basin with a few exceptions. Section three is a glossary of definitions for important terms used in the ordinance. Section four of the ordinance is titled "Limitations on Uses" and lists the three activities that are being prohibited by the ordinance. Section four prohibits any "new or expanded irrigated crop production", "conversion of dry [farming] or

grazing lands to new irrigated crop production", or "new development dependent upon a well in the groundwater basin" (Ordinance 3246, section 4). Section five of the ordinance lists some activities that are not subject to the ordinance, such as a minor modification or an efficiency improvement. Section six is similar to section five and lists categories that are exempt from the ordinance. Section seven is the "meat" of the document and establishes the offset clearance requirements for new development. In order to get clearance for construction on the activities listed in section four, the property owner must provide "evidence that the net water demand has been offset at a ratio of at least 1:1" (Ordinance 3246, section 7). For example, if a vineyard owner wished to increase his acreage by planting vines on a parcel of his land that would require 1 acre-foot of water annually to irrigate, he must first show proof that he is conserving 1 acre-foot of water in his current operations. The property owner must also measure and record all groundwater volumes pumped for the new construction. The final three sections of the ordinance explain the enforcement, severability, and effective date of the ordinance.

The ordinance can be understood as a temporary "patch" to prevent the situation from deteriorating further. By adopting the ordinance, the Board of Supervisors is preventing pumping volumes from increasing. Property owners will continue to pump the same amount of water, but they will be unable to pump any more water. If property owners wish to start new construction on their property, they must show that it will not result in pumping a larger volume of water. This will force the total pumping line in figure 4 to level out, and it will allow for more time to develop a management plan to protect the health of the water resource and protect the users of the groundwater basin.

Vested Rights

Section 6.A.4 of the Urgency Ordinance states that an exemption to the ordinance will be made if "satisfactory evidence can be provided that, prior to the effective date of this ordinance, an applicant has secured a vested right to complete site preparation, planting, or sale of product". This presents a problem, because there is no clear language in the ordinance that explains what is sufficient to be "satisfactory evidence". As a result, there were many petitions for vested rights. The Board of Supervisors could not simply accept all the petitions for vested rights because that would result in too much additional water pumping when the groundwater basin is in severe crisis. Therefore, an email was sent to addresses representing various individuals and groups interested in the issue of vested rights. 30 responses were received and a stakeholder group was created with representatives from many different groups. Those groups include: the Vineyard Team, PRAAGS, the Ag Commissioner's Office, PRO Water Equity, Blue Ribbon Committee, the Paso Robles Wine Country Alliance, and many other groups. That stakeholder group created a resolution that outlined a procedure to use when presented with a request for a vesting rights exemption. The resolution was approved by the Board of Supervisors on November 26, 2013 and then used to decide which claims will be approved and which will be denied.

Summary

The approval of Ordinance 3246 was an important step in solving the problem of the groundwater basin depletion. However it is only the first step towards a solution. The Paso Robles groundwater basin needs to be managed in a manner that will lead to the long-term health of the water resource and economic success for the area dependent on that resource. Therefore a long-term solution must be implemented to effectively protect the valuable water supply.

Part Three: The Solution

This part of the handbook will begin by introducing the Paso Robles Agricultural Alliance for Groundwater Solutions (PRAAGS) and the Paso Robles groundwater basin Overliers for Water Equity (PRO Water Equity). Both of these groups are dedicated to maintaining a healthy Paso Robles groundwater basin. This part of the handbook will also explain some of the early solutions to the crisis and the flaws with those solutions. Finally, the proposed Paso Robles Basin Water District will be explained in detail.

Early Solutions

There are many groups involved in finding solutions for the current groundwater basin situation. However, this handbook will focus on two groups (PRAAGS and PRO Water Equity). PRAAGS, consisting mainly of agricultural landowners, and PRO Water Equity, consisting mainly of rural residents, are emerging as leaders in finding a solution. These two groups offer contrasting opinions on water solutions, which is good because it ensures that more than one voice is being heard. PRAAGS' original solution to the basin crisis was to create a California Water District to manage pumping in the basin. In the proposed California Water District (CWD), influence and financial obligations will be distributed to landowners above the basin based on the water usage of the properties. Therefore, landowners who have operations that require great quantities of water for irrigation will bear a larger financial burden than small, rural-residential landowners. Also, the landowners who bear the heavier financial responsibility will have more influence in the district than the small, rural-residential landowners. However, PRO Water Equity does not support the creation of a California Water District. Leaders in the PRO Water Equity group fear that small landowners will not have a voice in a CWD. Moreover,

they feel that a CWD does not have sufficient water conservation powers and that a CWD lacks the ability to implement short-term solutions.

Paso Robles Basin Water District

On Dec. 5 of last year, PRO Water Equity and PRAAGS announced that they had reached agreement on a basic governance structure they could both support for the proposed Paso Robles Basin Water District. Both organizations sought to find middle ground that could accommodate groundwater needs for both agriculturists and rural homeowners. A major area of concern was how to fairly balance a future board of directors. Today the two groups have announced that they have further refined that management structure to consist of a nine-member board of directors. The district would be funded by fees levied on property, and it would have the power to manage and balance the basin. This means that the district could regulate pumping by metering wells. While there's been general agreement among basin property owners that some form of district is necessary, there's been a split over how the board should be elected. Some believe that each property owner should have a single vote in electing directors. Others believe that those with larger properties should get more votes because they will be paying more to finance the district's operations. A compromise was made that allowed some directors to be elected by popular vote and others by property owners. Three of the nine directors are to be elected by registered voters living within the district, and the remaining six directors would be elected by property owners. Two of the six directors will be elected by landowners who own less than 40 acres. Another two are to be elected by landowners with 40 and 400 acres, and the final two are to be elected by landholders who own 400 acres or more. Leaders from Pro Water

Equity and PRAAGS believe this makeup will prevent any one group from dominating the board.

Summary

Overall, there is still deliberation to take place in the near future regarding the solution to the over pumping of the Paso Robles groundwater basin. However, the proposed Paso Robles Basin Water District is gaining momentum in becoming the most acceptable solution to the situation. PRAAGS and PRO Water Equity are working with Assemblyman Katcho Achadjian to prepare a special legislation bill to form a water district before the legislature in Sacramento.

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Chapter Five

Summary, Recommendations, and Conclusion

Summary

This chapter provides a final overview of this project. Beginning with general research on the groundwater systems and ending with writing about the currently proposed water district, this project follows the story of the Paso Robles groundwater basin crisis. Extensive research was done on many relevant sides of the problem, and proposed solutions were explained in detail. In addition, confusing legislation was simplified to be easily digested by the reader. "The PR Groundwater Basin: An Informational Handbook" accurately describes the transformation of a dire situation to the hope of a better managed resource.

Recommendations

This project will quickly become outdated as the situation is constantly evolving. Progress will be made in the implementation of a management structure to govern the Paso Robles groundwater basin. Therefore, there will be new information to add to the handbook. However, the current handbook provides accurate background information on the basin as well as a comprehensive recollection of the major events that have happened up until the close of February 2014.

Conclusion

There is much potential for this document to be used as an educational tool, if it can be consistently updated as progress is made.

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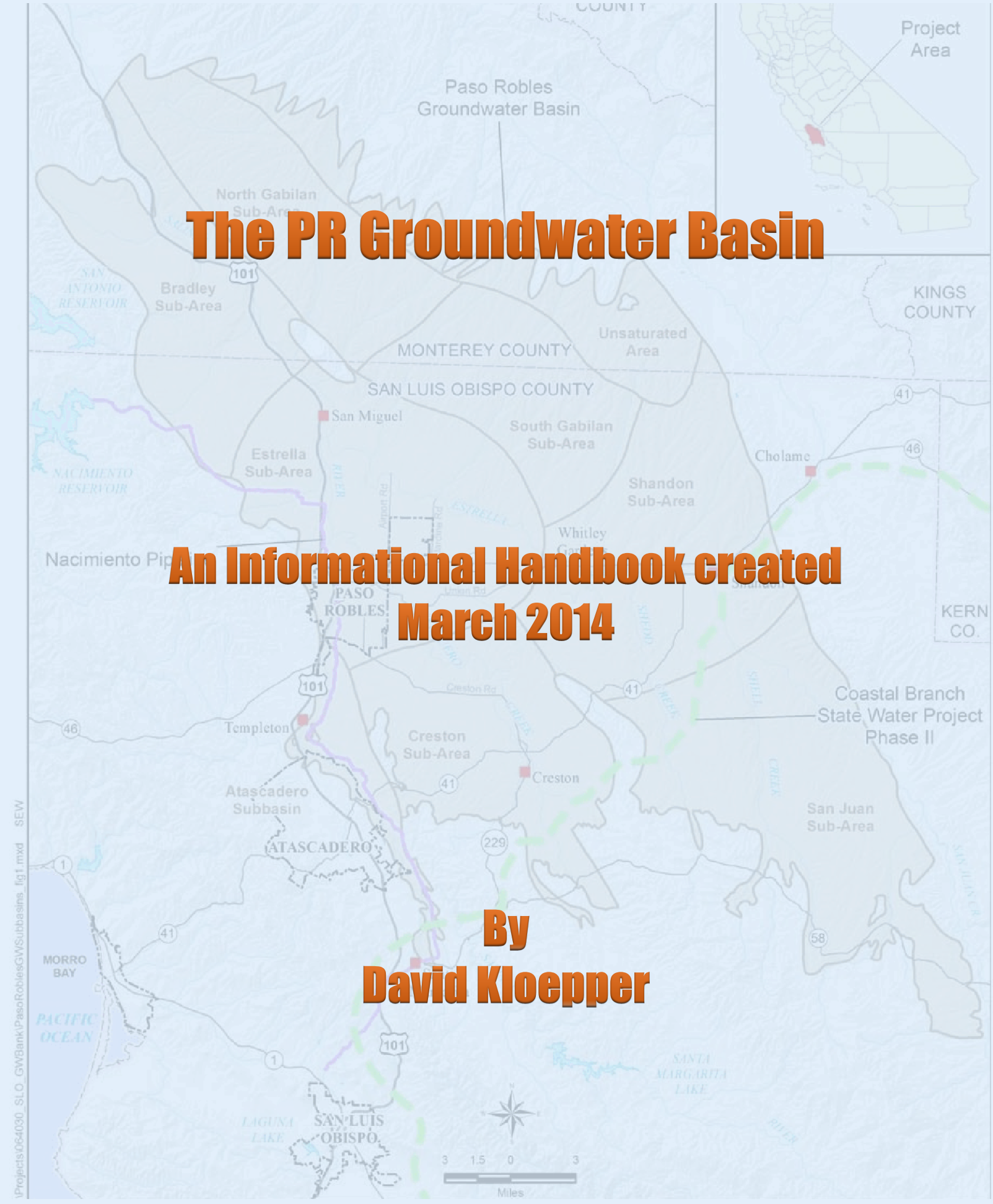
Appendix A

"The PR Groundwater Basin"



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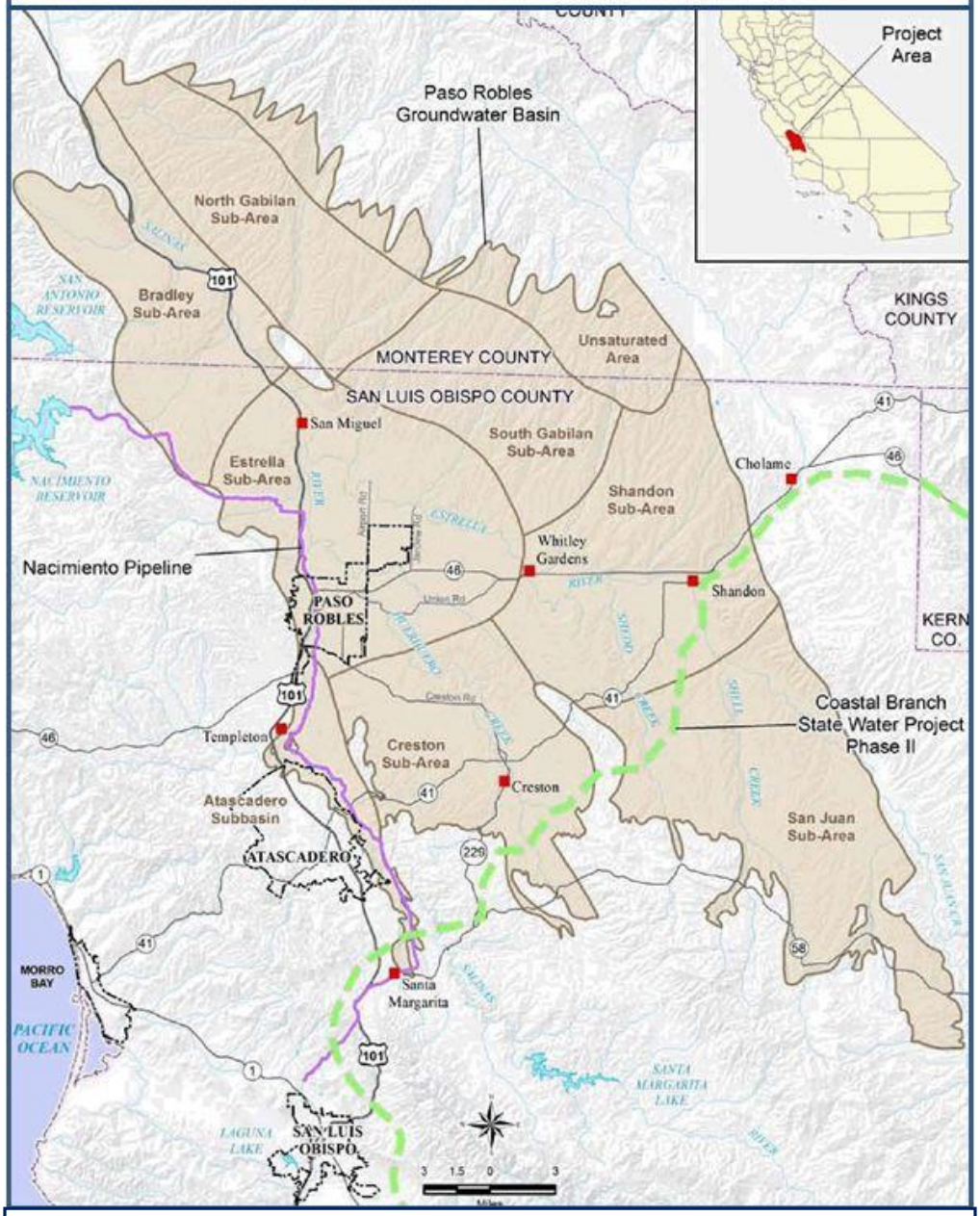
Part One: Background Information

In order to better understand some of the proposed solutions to the groundwater basin crisis, it is first important to have some background knowledge about the Paso Robles groundwater basin. This part of the handbook will explain some of the geography and physical characteristics of the groundwater basin, and it will explain how groundwater pumping has changes over the last decade. The topic of groundwater basin subsidence will also be covered, as it is a result of over pumping groundwater basins.

The Paso Robles Groundwater Basin

The Paso Robles groundwater basin is a massive water resource extending from Atascadero to San Ardo in Monterey County (south to north) and from Shandon to the Highway 101 corridor (east to west). That area totals to be 505,000 acres. In order to better understand the groundwater basin, a resource capacity study was conducted on the water supply in the Paso Robles groundwater basin and adopted by the San Luis Obispo County Board of Supervisors in February of 2011. One important characteristic of groundwater basins is the perennial yield of that groundwater basin. The resource capacity study quoted the Furgo 2002 report to define perennial yield as "the amount of usable water of a groundwater basin that can be withdrawn and consumed economically each year for an indefinite period of time." If a volume larger than the perennial yield is pumped from a groundwater basin, the long-term health of the basin will be threatened and may result in diminished storage capacity. The perennial yield of the groundwater basin was calculated to be 97,700 acre-feet/year (Giffin et al., 2011). Below is a map of the Paso Robles Groundwater Basin.

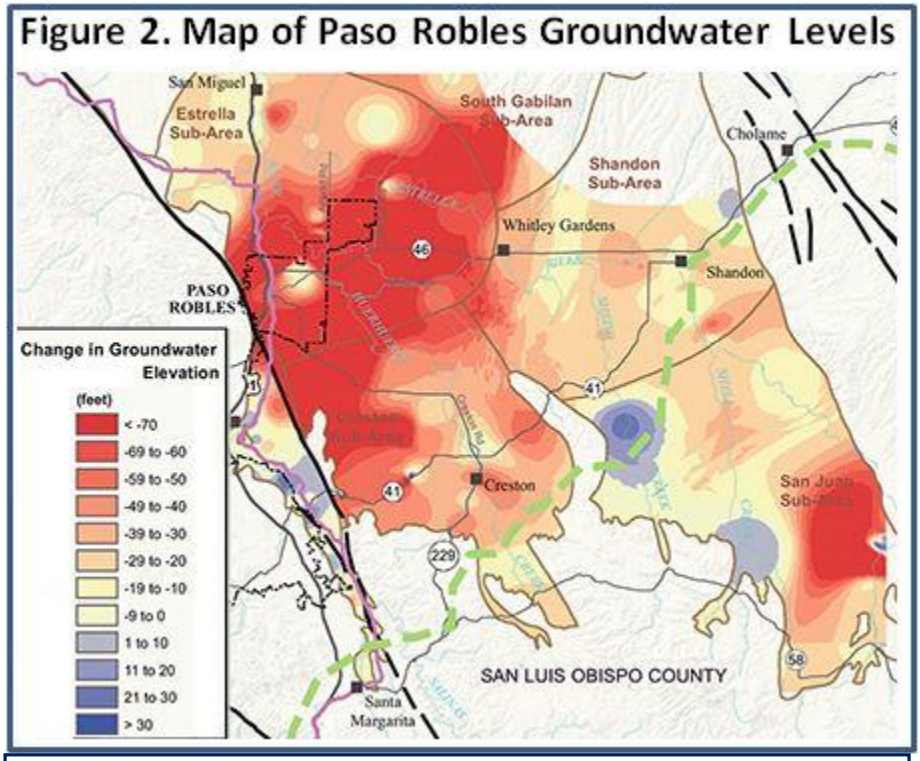
Figure 1. Map of Paso Robles Groundwater Basin



Map Found on Blue Ribbon Committee Website

Over the past decade, pumping volumes of groundwater have increased to the point that the health of the Paso Robles groundwater basin is being threatened. This threat is better visualized in Figure 2 (see next page) that shows how the groundwater levels have changed for

some areas of the groundwater basin. In many places, the groundwater elevation has decreased by an astounding 70 feet (the area shaded red).



Map Found in the article "Water Worries in Paso Wine Country" by Andrew Adams

Groundwater Basin Subsidence

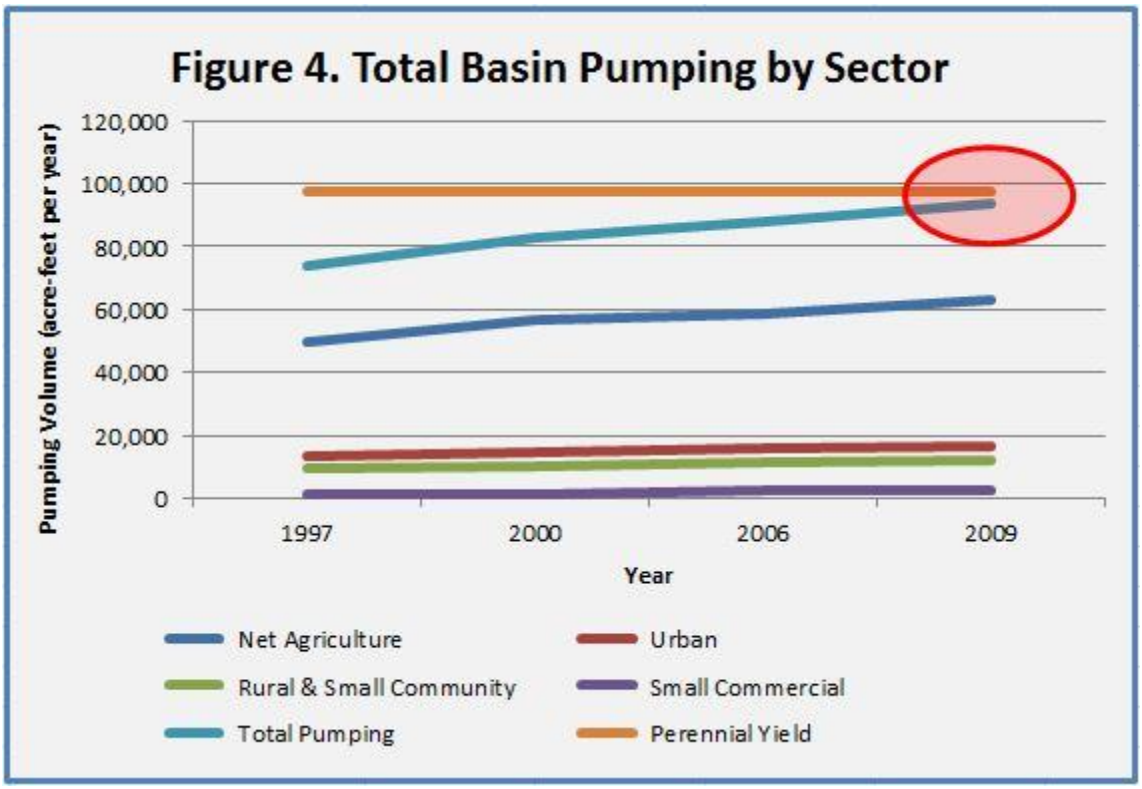
This over-pumping of water from the basin presents a terrifying possibility: land subsidence due to groundwater depletion. Subsidence occurs when pumping volumes exceed the perennial yield of a groundwater basin. "Land subsidence due to groundwater overdraft is essentially irreversible" (Bouwer, 1977). Therefore, once the water storage of the groundwater basin is diminished it cannot be recovered. If land subsidence were to happen to Paso Robles groundwater basin, the economy of that part of the county would suffer greatly. Production agriculture (namely vineyards) and agricultural tourism (namely wineries) are major driving factors in the economy of the Paso Robles area. The wineries and vineyards in the area are also

gaining worldwide recognition after winning the Wine Enthusiast Magazine's 2013 Wine Region of the Year award (Heimoff, 2013). In recent years, pumping volumes have increased dramatically. This is a result of an increase in the populations of cities above the groundwater basin and an increase of production agriculture in the area. Below is a table that contains data on pumping volumes for 1997, 2000, 2006, and 2009.

Figure 3. Table of Groundwater Basin Pumping Volumes

Groundwater User	1997	2000	2006	2009
Net Agriculture	49,683	56,551	58,680	63,077
Urban	13,513	14,629	15,665	16,382
Rural & Small Community	9,400	9,993	11,485	11,817
Small Commercial	1,465	1,465	2,323	2,631
Total	**74,061**	**82,638**	**88,153**	**93,907**

Users of the groundwater basin can be classified into one of four categories: agriculture, urban (municipal users), rural residents (including small community systems), and small commercial systems (such as golf courses and wineries). The increase in pumping volumes is more easily seen in Figure 4 which depicts a line graph of the data in the table above. The red highlighted area in Figure 4 below shows that the total pumping (light blue line) is approaching the perennial yield (orange line) of the groundwater basin.



Summary

The 2010 estimates of the pumping volumes for the basin are 91,838 to 96,723 acre-feet per year (Giffin et al, 2011). That is an astounding 94% to 99% of the perennial yield of the basin. It is quite apparent that if pumping volumes continue to increase then negative consequences (such as land subsidence or saline intrusion) may occur. A major change in the management of the Paso Robles groundwater basin must be devised and implemented swiftly to prevent irreversible damage to the production agriculture operations, the communities in the area, and San Luis Obispo County as a whole.

Part Two: The Urgency Ordinance

This part of the handbook is dedicated to explain the Urgency Ordinance. After first explaining the purpose of Ordinance 3246, this section will then explain some of the exceptions to the ordinance. The body responsible for approving the urgency ordinance is the San Luis Obispo Board of Supervisors. "The San Luis Obispo Board of Supervisors, the legislative arm of the County government, is committed to the implementation of such policies and the provision of such services that will enhance the economic, environmental and social quality of life in San Luis Obispo County" (Board of Supervisors Mission Statement).

Ordinance 3246

Since the situation in North County has become so dire, the Board of Supervisors approved Ordinance 3246 (the Urgency Ordinance) for 45 days on August 27, 2013. On October 8, 2013, the Board of Supervisors extended the Urgency Ordinance for the maximum two years (until August 27, 2015). The ordinance is a ten page document that is broken down into ten different sections. The first three pages of the document are dedicated to section one which is titled "Findings and Declarations". The section explains the dire situation of the basin, physical characteristics, and other findings the County has discovered through studies such as the Resource Capacity Study (Similar to what is described in part one of this handbook). Section two of the ordinance simply asserts that the ordinance applies to all properties that overlie the Paso Robles groundwater basin with a few exceptions. Section three is a glossary of definitions for important terms used in the ordinance. Section four of the ordinance is titled "Limitations on Uses" and lists the three activities that are being prohibited by the ordinance. Section four prohibits any "new or expanded irrigated crop production", "conversion of dry [farming] or

grazing lands to new irrigated crop production", or "new development dependent upon a well in the groundwater basin" (Ordinance 3246, section 4). Section five of the ordinance lists some activities that are not subject to the ordinance, such as a minor modification or an efficiency improvement. Section six is similar to section five and lists categories that are exempt from the ordinance. Section seven is the "meat" of the document and establishes the offset clearance requirements for new development. In order to get clearance for construction on the activities listed in section four, the property owner must provide "evidence that the net water demand has been offset at a ratio of at least 1:1" (Ordinance 3246, section 7). For example, if a vineyard owner wished to increase his acreage by planting vines on a parcel of his land that would require 1 acre-foot of water annually to irrigate, he must first show proof that he is conserving 1 acre-foot of water in his current operations. The property owner must also measure and record all groundwater volumes pumped for the new construction. The final three sections of the ordinance explain the enforcement, severability, and effective date of the ordinance.

The ordinance can be understood as a temporary "patch" to prevent the situation from deteriorating further. By adopting the ordinance, the Board of Supervisors is preventing pumping volumes from increasing. Property owners will continue to pump the same amount of water, but they will be unable to pump any more water. If property owners wish to start new construction on their property, they must show that it will not result in pumping a larger volume of water. This will force the total pumping line in figure 4 to level out, and it will allow for more time to develop a management plan to protect the health of the water resource and protect the users of the groundwater basin.

Vested Rights

Section 6.A.4 of the Urgency Ordinance states that an exemption to the ordinance will be made if "satisfactory evidence can be provided that, prior to the effective date of this ordinance, an applicant has secured a vested right to complete site preparation, planting, or sale of product". This presents a problem, because there is no clear language in the ordinance that explains what is sufficient to be "satisfactory evidence". As a result, there were many petitions for vested rights. The Board of Supervisors could not simply accept all the petitions for vested rights because that would result in too much additional water pumping when the groundwater basin is in severe crisis. Therefore, an email was sent to addresses representing various individuals and groups interested in the issue of vested rights. 30 responses were received and a stakeholder group was created with representatives from many different groups. Those groups include: the Vineyard Team, PRAAGS, the Ag Commissioner's Office, PRO Water Equity, Blue Ribbon Committee, the Paso Robles Wine Country Alliance, and many other groups. That stakeholder group created a resolution that outlined a procedure to use when presented with a request for a vesting rights exemption. The resolution was approved by the Board of Supervisors on November 26, 2013 and then used to decide which claims will be approved and which will be denied.

Summary

The approval of Ordinance 3246 was an important step in solving the problem of the groundwater basin depletion. However it is only the first step towards a solution. The Paso Robles groundwater basin needs to be managed in a manner that will lead to the long-term health of the water resource and economic success for the area dependent on that resource. Therefore a long-term solution must be implemented to effectively protect the valuable water supply.

Part Three: The Solution

This part of the handbook will begin by introducing the Paso Robles Agricultural Alliance for Groundwater Solutions (PRAAGS) and the Paso Robles groundwater basin Overliers for Water Equity (PRO Water Equity). Both of these groups are dedicated to maintaining a healthy Paso Robles groundwater basin. This part of the handbook will also explain some of the early solutions to the crisis and the flaws with those solutions. Finally, the proposed Paso Robles Basin Water District will be explained in detail.

Early Solutions

There are many groups involved in finding solutions for the current groundwater basin situation. However, this handbook will focus on two groups (PRAAGS and PRO Water Equity). PRAAGS, consisting mainly of agricultural landowners, and PRO Water Equity, consisting mainly of rural residents, are emerging as leaders in finding a solution. These two groups offer contrasting opinions on water solutions, which is good because it ensures that more than one voice is being heard. PRAAGS' original solution to the basin crisis was to create a California Water District to manage pumping in the basin. In the proposed California Water District (CWD), influence and financial obligations will be distributed to landowners above the basin based on the water usage of the properties. Therefore, landowners who have operations that require great quantities of water for irrigation will bear a larger financial burden than small, rural-residential landowners. Also, the landowners who bear the heavier financial responsibility will have more influence in the district than the small, rural-residential landowners. However, PRO Water Equity does not support the creation of a California Water District. Leaders in the PRO Water Equity group fear that small landowners will not have a voice in a CWD. Moreover,

they feel that a CWD does not have sufficient water conservation powers and that a CWD lacks the ability to implement short-term solutions.

Paso Robles Basin Water District

On Dec. 5 of last year, PRO Water Equity and PRAAGS announced that they had reached agreement on a basic governance structure they could both support for the proposed Paso Robles Basin Water District. Both organizations sought to find middle ground that could accommodate groundwater needs for both agriculturists and rural homeowners. A major area of concern was how to fairly balance a future board of directors. Today the two groups have announced that they have further refined that management structure to consist of a nine-member board of directors. The district would be funded by fees levied on property, and it would have the power to manage and balance the basin. This means that the district could regulate pumping by metering wells. While there's been general agreement among basin property owners that some form of district is necessary, there's been a split over how the board should be elected. Some believe that each property owner should have a single vote in electing directors. Others believe that those with larger properties should get more votes because they will be paying more to finance the district's operations. A compromise was made that allowed some directors to be elected by popular vote and others by property owners. Three of the nine directors are to be elected by registered voters living within the district, and the remaining six directors would be elected by property owners. Two of the six directors will be elected by landowners who own less than 40 acres. Another two are to be elected by landowners with 40 and 400 acres, and the final two are to be elected by landholders who own 400 acres or more. Leaders from Pro Water

Equity and PRAAGS believe this makeup will prevent any one group from dominating the board.

Summary

Overall, there is still deliberation to take place in the near future regarding the solution to the over pumping of the Paso Robles groundwater basin. However, the proposed Paso Robles Basin Water District is gaining momentum in becoming the most acceptable solution to the situation. PRAAGS and PRO Water Equity are working with Assemblyman Katcho Achadjian to prepare a special legislation bill to form a water district before the legislature in Sacramento.

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