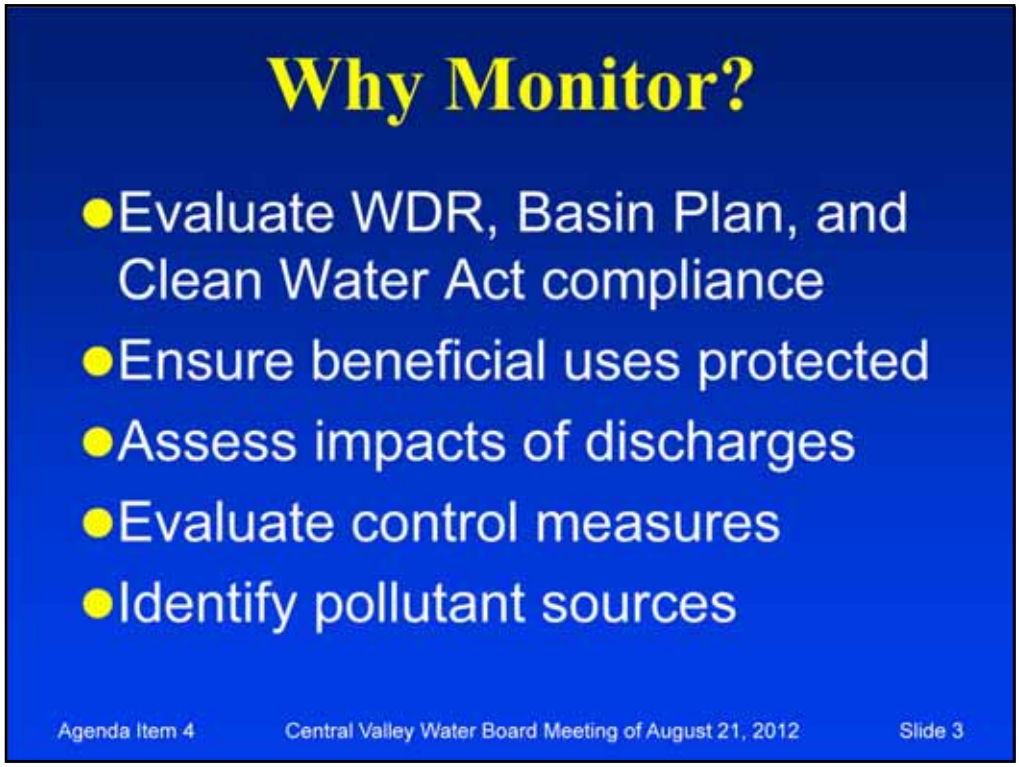
Good morning Chairman Longley and members of the Board. My name is Joe Karkoski and I am the program manager for the irrigated lands regulatory program.

Today, Clay Rodgers and I will provide you with an overview of the proposed surface water and groundwater monitoring strategies for the Irrigated Lands Regulatory Program and how these compare with monitoring being conducted in other programs at the Central Valley Water Board.

First, I will briefly describe why monitoring is needed and what elements must be included in any water quality monitoring strategy, whether it is surface water or groundwater. I will also discuss information that is needed in addition to monitoring data to assess compliance.

I will then talk about surface water monitoring considerations, how they apply to the Irrigated Lands Regulatory Program, and how this contrasts with other Board Programs.

This will be followed by a detailed discussion of groundwater monitoring considerations by Clay Rodgers.



So, why do we require monitoring? Generally, we require monitoring to assess compliance with state and federal regulations, as well as with Regional Water Board Orders. These Orders implement regulations found in our Basin Plan, the Clean Water Act, and the California Water Code, or Title 27 of the California Code of Regulations.

The surface water and groundwater monitoring that we are talking about today is typically done to confirm compliance with the conditions in our orders, such as receiving water limits, and to confirm that beneficial uses are being protected. Monitoring results are often used to assess the impacts of discharges, evaluate the effectiveness of control measures, or help identify sources of pollution.

The development of a monitoring program strategy requires decisions in four main areas.

This includes:

- what constituents to measure or test
- where and how many sample collection locations are needed
- when and how often samples will be taken; and
- what the appropriate field and laboratory methods are.

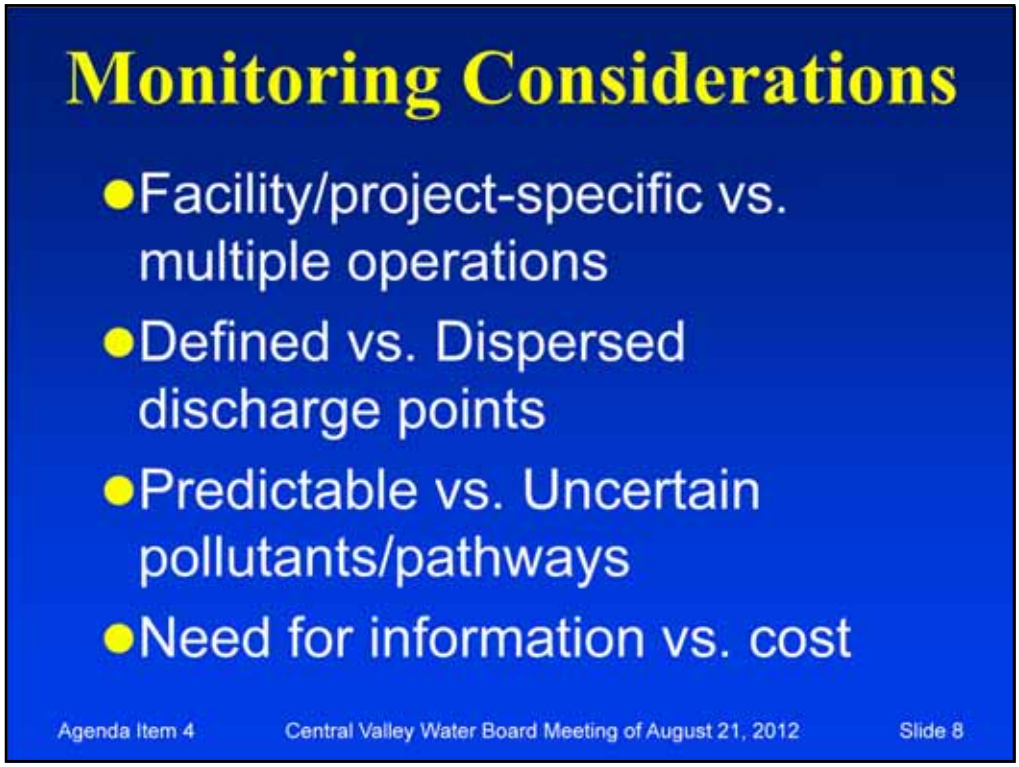
Careful planning and implementation of these monitoring elements is needed to ensure that the objectives and requirements of the regulatory program are met. If any of the parts are not adequately addressed, it may not be possible to determine compliance or evaluate the effects of discharge on water quality.

While monitoring data is a critical element needed to assess compliance with water quality regulations, there are other elements as well. It is important to know what type of management practices and control measures are already in place and which new practices are being implemented. It is also important that accurate data analyses and comprehensive reporting are available for decision-making. That analysis includes determining whether management practices are effective and assessing trends in water quality – are we seeing improvement?

For the surface water portion of this presentation, I will talk about the key considerations that go into developing a monitoring strategy. I will describe how the characteristics of irrigated agriculture operations inform our monitoring program, and contrast this with examples from two other Regional Board programs. Lastly, I will talk about the regional monitoring approach used for surface waters in the Irrigated Lands Regulatory Program.

This diagram illustrates some of the multiple inputs that commonly contribute to surface water quality conditions, including: irrigated agricultural operations, livestock grazing, timber management, urban storm water runoff, wastewater treatment discharges, and septic systems. In addition to discharges that occur on the surface, subsurface leaching and groundwater recharge can reach surface waters and impact water quality.

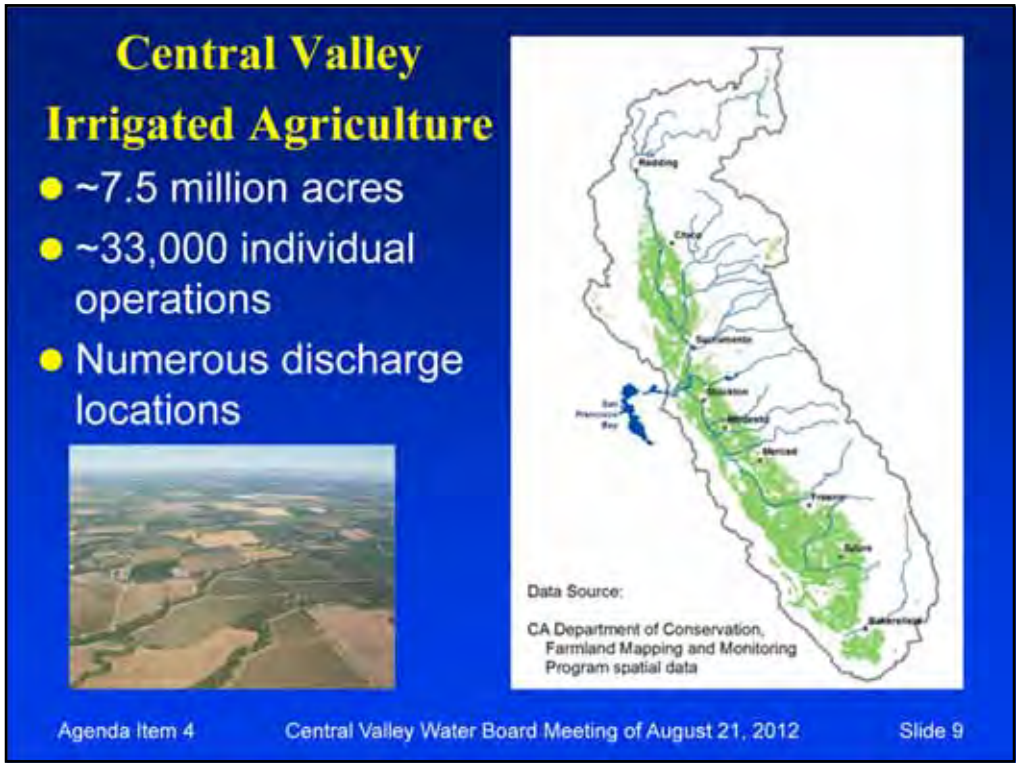
When deciding on a monitoring strategy, it is important to keep in mind the complexity of the natural hydrologic system, as well as the potential effects from a variety of land uses and facilities.



The strategy for monitoring surface water quality in any program depends on many factors. Some key considerations are as follows:

- Is there a specific facility or project operated by one entity? Or, are there many different operations and entities?
- Is there a defined discharge point or many dispersed points of discharge?
- Are the expected pollutants, their timing, and their discharge pathways predictable or uncertain?
- Lastly, how does the cost of monitoring compare with the need for the data?

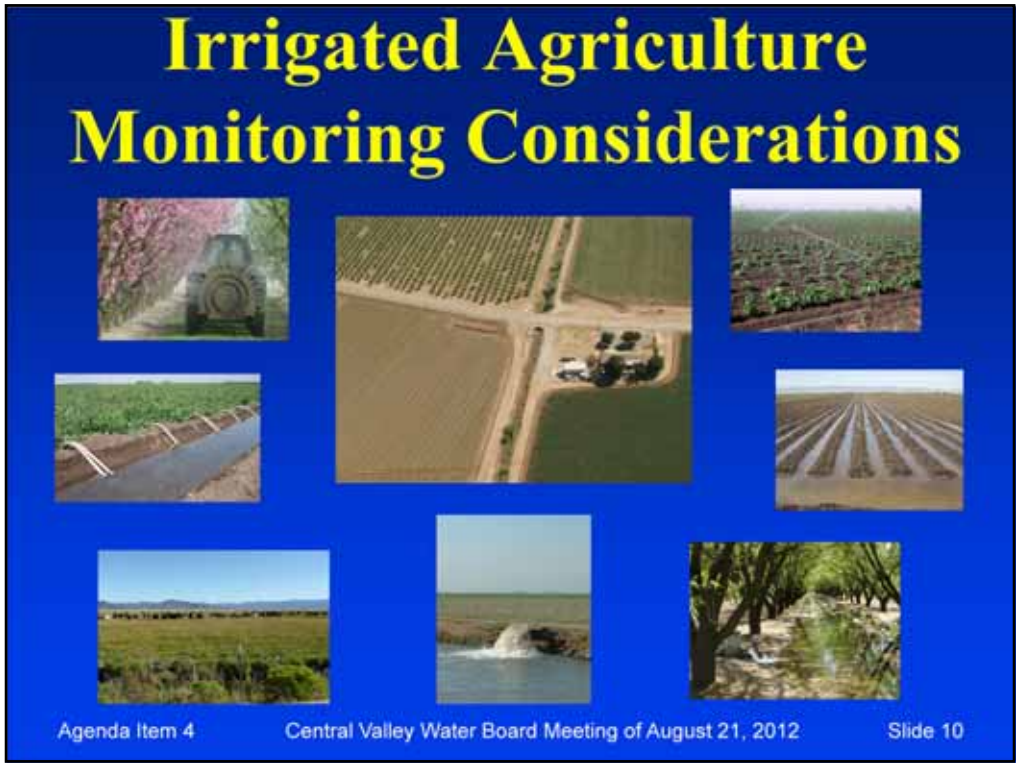
As I will discuss next, the answers to these questions inform what type of surface water monitoring approach will be most effective.



It is important to understand how the characteristics of irrigated agriculture operations differ from those regulated under other Regional Board programs..

Irrigated agriculture operations cover an extensive area of approximately 7.5 million acres throughout the Central Valley region with approximately 33,000 individual operations present. The green areas shown on this map of the Central Valley region show where irrigated agriculture is present. There are numerous points of discharge into receiving water bodies and the effects on water quality can be continuous, seasonal, or irregular.

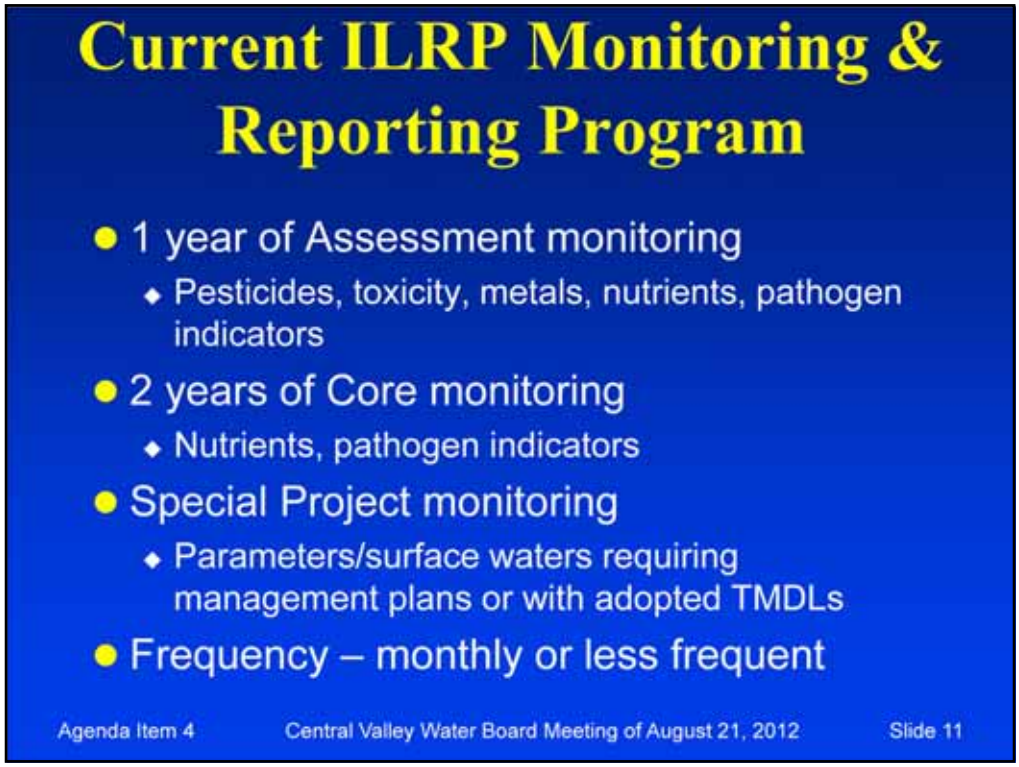
While it is appropriate to require facility or site-specific monitoring in other Water Board programs, it would not be feasible or effective to conduct surface water monitoring for each irrigated agriculture operation in the Central Valley. Due to the large number and extent of operations, we believe that monitoring would be more effectively conducted on a regional basis.



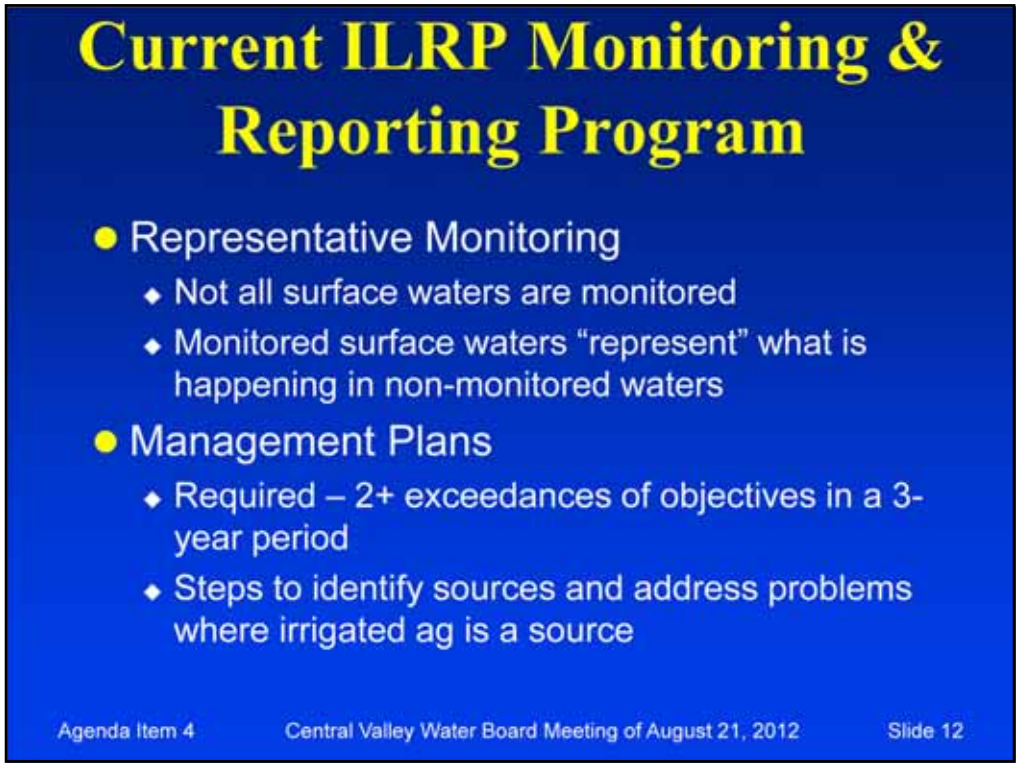
A wide range of potential pollutants can originate from irrigated agriculture operations, including, for example, sediment, nutrients, pesticides, pathogens, salts, and metals. However, their presence is not reliably predictable and varies in both space and time.

Many factors make predicting agricultural discharges inexact.

Examples include rotations in crops, varying climate and soil conditions, changing agricultural practices, and changing threats to crops. The implementation of management practices to control pollutants is not fully documented. However, the measures and practices that prevent surface water pollution are fairly well-established, as is knowledge of proper implementation.



The current irrigated lands surface water monitoring is based on a three year rotating cycle. One year of extensive monitoring, referred to as Assessment Monitoring, is required for pesticides, toxicity, metals, nutrients and pathogen indicators. Reduced monitoring of nutrients and pathogen indicators, referred to as Core Monitoring, is conducted for the next two years before the next cycle of assessment monitoring is conducted. Monitoring of parameters and surface waters with management plans or monitoring associated with Total Maximum Daily Loads or TMDLs is referred to as special project monitoring. The frequency of monitoring is generally monthly, but can be less frequent. For example, some pesticide monitoring may only take place in the months the pesticides are used.



The monitoring approach is a "representative" monitoring approach. I'll show you a couple of figures in a minute to explain this more fully. Basically, not all of the surface waters receiving agricultural discharge are being monitored. The sites that are monitored are associated with, or "represent" what is occurring in non-monitored sites. Once the Coalitions receive the monitoring results, they determine whether water quality objectives have been exceeded. If there are two or more exceedances in a three year period, then a management plan needs to be prepared. The management plan identifies the steps that will be taken to identify sources and address any problems where irrigated agriculture is a contributing source.

In contrast to irrigated agriculture operations, a wastewater treatment plant is a unique facility with a single discharge point, a well-defined source area, predictable pollutants with well-defined pathways, generally continuous or regular discharge, and well-documented measures implemented to prevent pollutant discharges. It is feasible and effective to regulate and monitor wastewater treatment facilities on an individual basis.

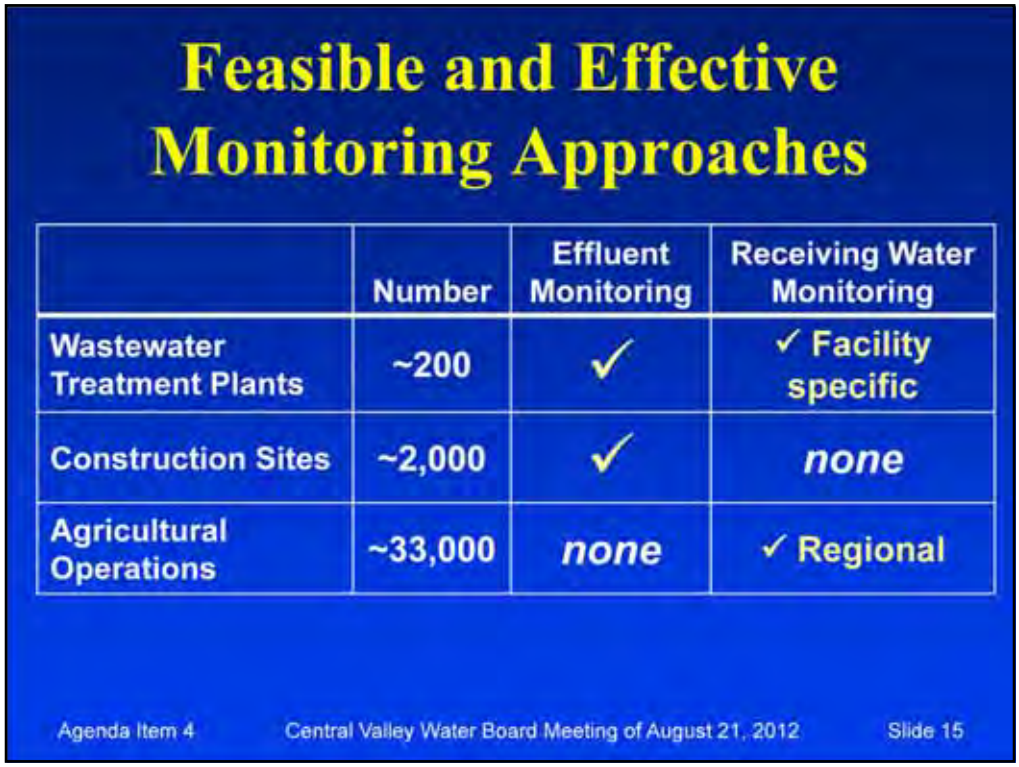
Under the NPDES Wastewater Program there are more than 200 individual wastewater treatment plants permitted in Region 5. Monitoring of the effluent discharge is required, as is surface water monitoring both upstream and downstream in the receiving water body.

This aerial photo shows the typical monitoring setup, which would be similar for any facility or project monitored under the NPDES program.

Another example is construction projects, which are site-specific, have a limited number of discharge pathways, a well-defined source area, and source controls that are well-established and documented. Currently, there is a statewide general NPDES permit for construction sites. Under this storm water Construction General Permit, monitoring would be conducted on a site-specific basis.

Whether monitoring is needed depends on the degree and extent of disturbance and the project location. Generally, monitoring applies to storm water runoff from the project site. The number of active permits under this program ranges from about 1,000 to 2,400 construction sites.

It is feasible to conduct runoff monitoring for construction sites and similar projects on a site-specific basis because the size, timing, and activities are defined and predictable. Specific monitoring requirements may be limited or extensive, as determined by the Executive Officer, and are dependent upon observations of the effectiveness of implemented measures.

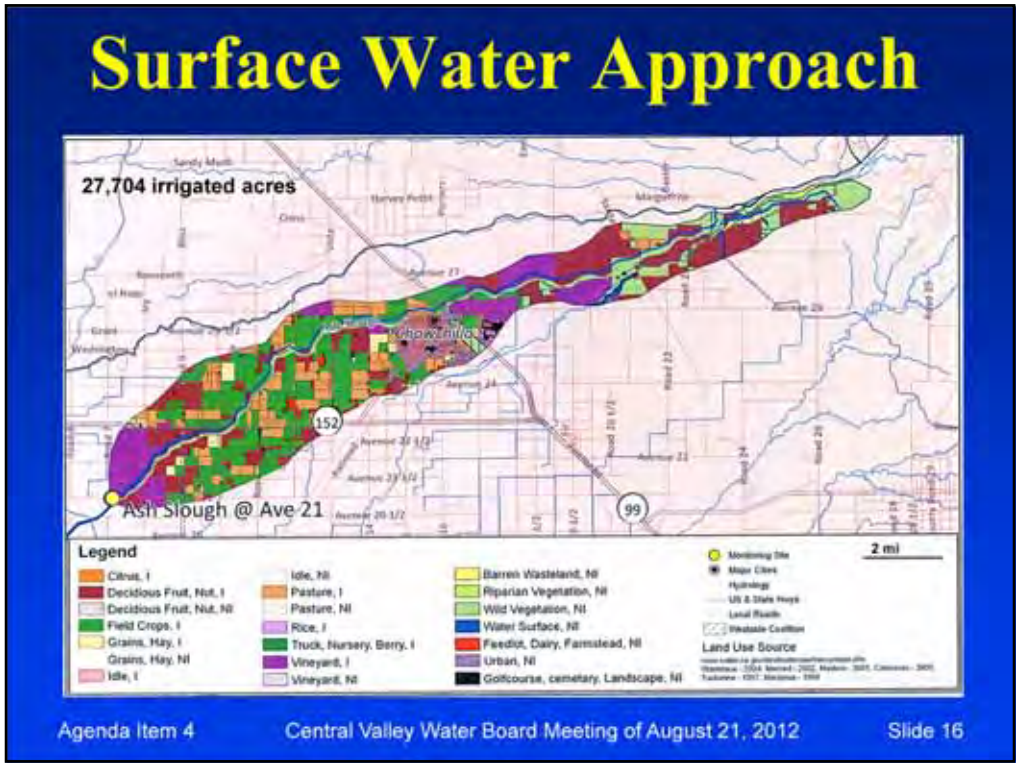


To recap the main reasons why we have a regional monitoring approach for surface waters, I want to emphasize the difference in scale between the NPDES programs and the Irrigated Lands program.

At about 200 individual facilities, effluent monitoring and facility specific receiving water monitoring is required for treatment plants.

At about 2,000 individual projects, effluent monitoring may be required for construction sites. Receiving water monitoring is not required.

At about 33,000 individual operations, surface water monitoring for irrigated agriculture would be most feasible and effective in receiving waters on a regional basis. Monitoring on an individual basis would be cost prohibitive and unmanageable for both the dischargers and the Regional Water Board.



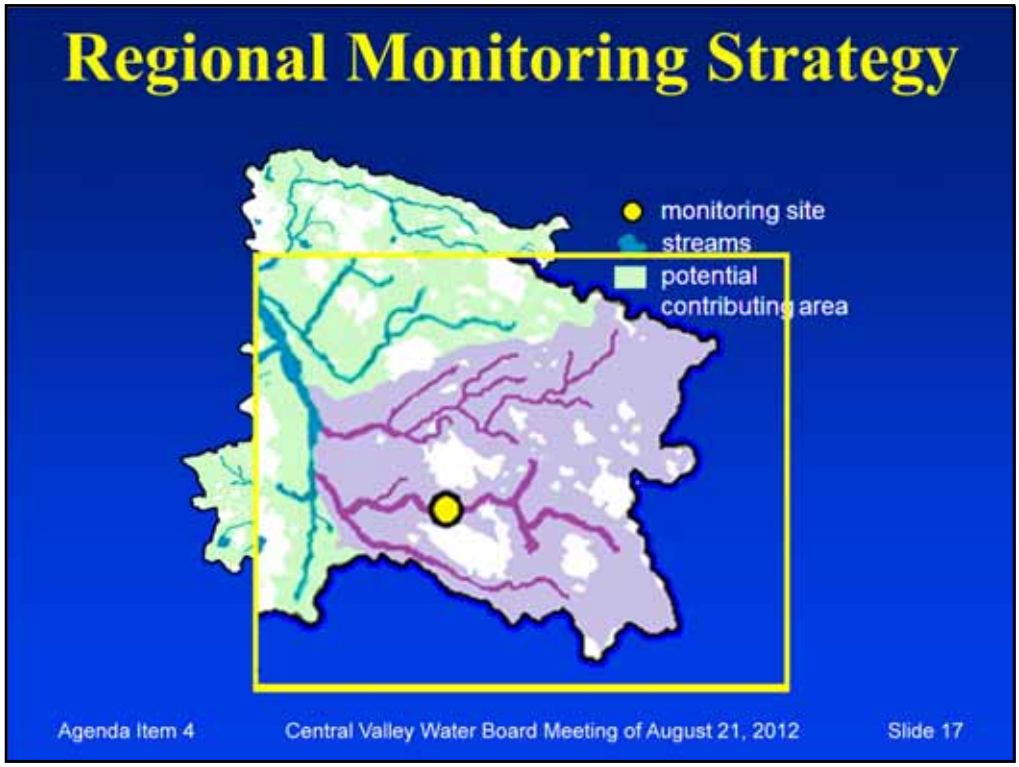
In this example, I will give you a general idea of how a regional surface water monitoring strategy would be applied.

This map illustrates the large number of parcels and variety of crops present within just one drainage area where a management plan will be implemented. Each square or rectangle represents a unique agricultural parcel. Note the main water body, which is represented by this dark blue line. The monitoring site for this drainage is shown by the yellow dot located at the bottom left corner of the map, which is in the downstream portion of the drainage. The different colored blocks represent different land uses and crop types. In this example, vineyards, fruit and nut orchards, row crops, and irrigated pasture are the common crops in the watershed. Surface water monitoring at the designated monitoring site represents inputs from all crop types that discharge in the drainage area.

Because monitoring is conducted near the downstream end of the receiving water body, and not directly in the discharge from agricultural fields, dilution of upstream discharges will likely occur. While this is a disadvantage in this monitoring approach, it does allow us to understand the overall water quality impact from many different operations on ambient water quality conditions. It also allows water quality problems to be addressed throughout the

watershed more quickly than if discharge monitoring data for each parcel had to be evaluated.

When a water quality problem is observed, the management plan process must enable the Coalition to determine what is going on upstream. To be successful, a regional monitoring strategy must be supplemented by grower-specific information, such as the pesticides used or management practices implemented. With the grower-specific information, the Coalition and Board can identify potential sources of water quality problems and follow up with those individuals.



Using a regional approach typically means that monitoring does not occur in all water bodies. In this schematic map, streams are shown in dark blue and the contributing drainage areas are shown by the blue-green colored areas. As this example shows, a variety of monitoring sites are selected as primary monitoring locations within a number of drainages, and the data collected are used as an indicator or represent water quality conditions in similar drainages. Additional elements of the surface water monitoring strategy will be unique to each Coalition area.

In a regional monitoring approach, the number of monitoring sites must be sufficient to provide geographic coverage and characterize the variety of crops grown within the area of interest. At the same time, if a water quality problem is identified, the associated watershed areas must not be so large that source identification and grower outreach efforts are ineffective.

In summary, monitoring data from the Irrigated Lands Regulatory Program would be used to meet a variety of program objectives. Monitoring is required to evaluate compliance with WDRs and to ensure protection of beneficial uses. It is used to assess the impacts of irrigated agriculture discharges to surface water bodies and to evaluate the effectiveness of implemented management practices.

Because of the spatial extent and large number of irrigated agriculture operations in the Central Valley region, regional monitoring is an efficient and effective means to gather surface water quality data. While this approach does not allow us to identify if, or what, a specific operation is discharging, it does allow us to identify areas where significant water quality problems exist and then refine and focus efforts to identify and address the sources of the problems. We believe that this approach can result in timely detection of water quality problems and in effective strategies to correct water quality problems.

Questions?

Chairman Longley and members of the Board, my name is Clay Rodgers, an AEO in your Fresno office. I am here today to talk about groundwater monitoring and the ILRP.

The groundwater part of the presentation will include:

1. An introduction that talks about:

   a) Background information on the Central Valley Groundwater Basin

   b) Basic information regarding dischargers in the Central Valley, and

   c) Introductory information on groundwater occurrence and flow

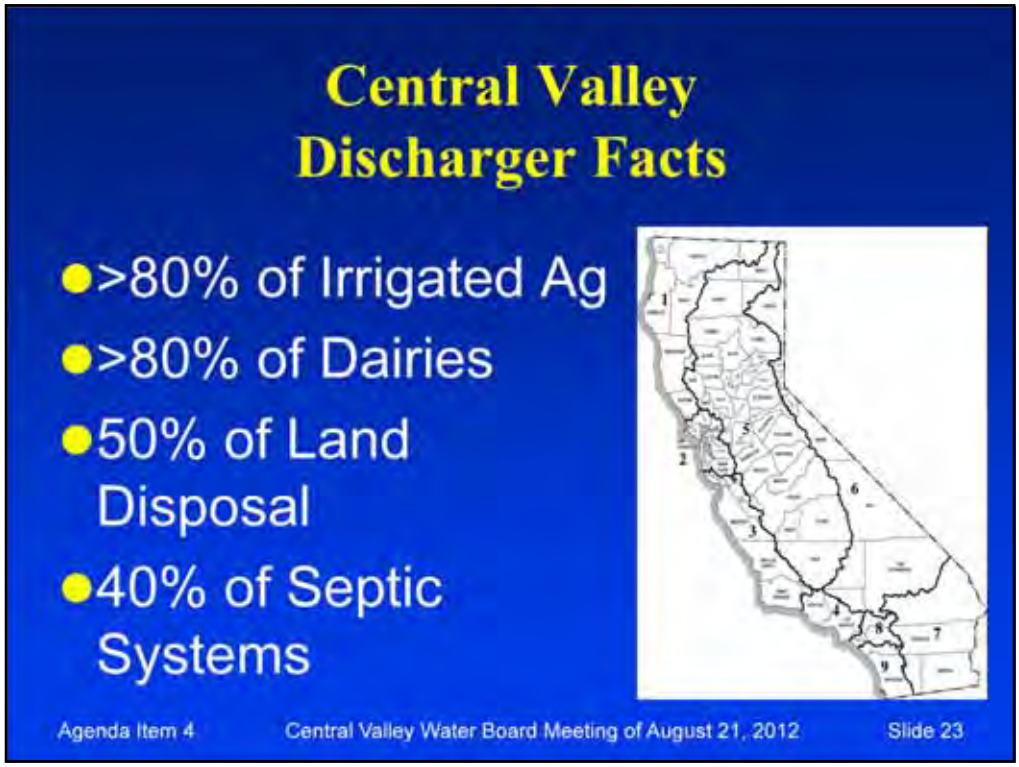
Also included will be background information on groundwater programs overseen by the CVWB and a discussion of how historically, groundwater monitoring has been conducted.

3. I will finish with a discussion of the groundwater monitoring requirements staff is recommending be incorporated into the irrigated lands regulatory program general orders that will be brought for your consideration beginning in October.

I'd like to present some groundwater facts that emphasize the critical role groundwater plays in the valley. These include:

The central valley has the second largest contiguous groundwater basin in the US and the largest in California

According to the Department of Water Resources, groundwater in California supplies almost 50% of the domestic and public drinking water supply and in the Central Valley groundwater provides more than 50% of the drinking water supply. In many communities, particularly in the South Valley, groundwater is the sole source for public drinking water supplies.



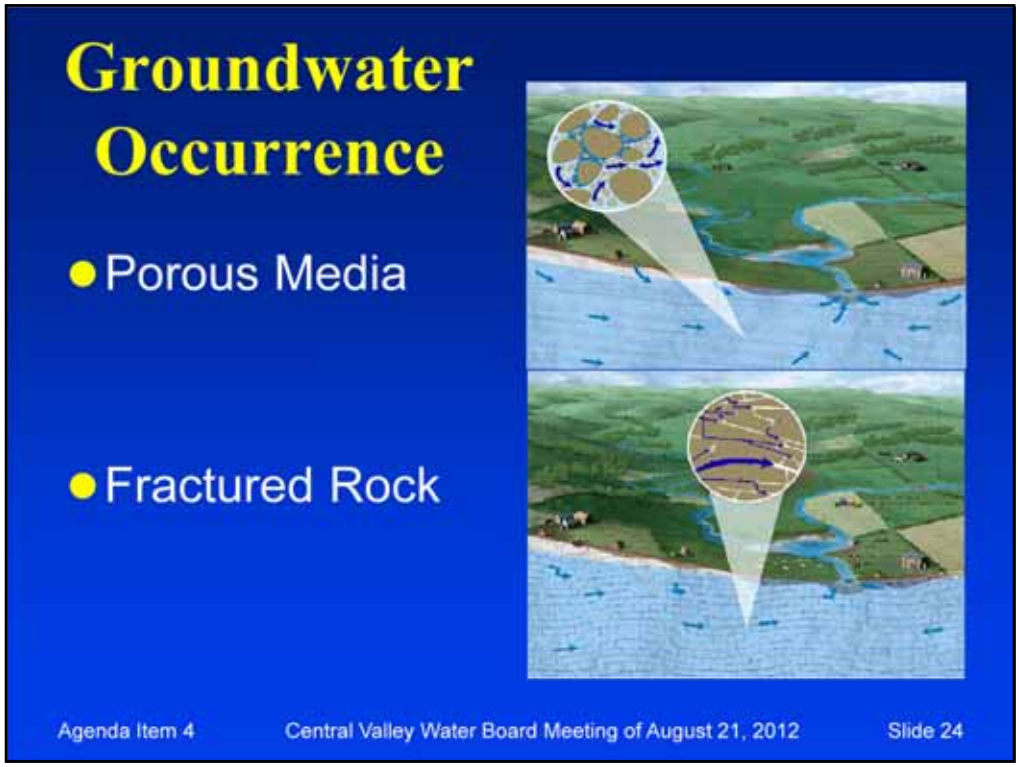
Groundwater in the Central Valley is intensively used for a multitude of purposes that include agricultural irrigation, municipal and domestic water supply, and industrial operations. There are also a multitude and variety of dischargers operating in the central valley, a few percentages worth noting include:

- In the central valley, ag is a multi-billion dollar industry and over 80% of all the irrigated lands and dairies within California are in this area.

- Approximately 50% of all waste discharges regulated under the land disposal program in California are located within the Central Valley Region (these are discharges from facilities such as from WWTPs, food processers, and landfills; and

- Approximately 40% of all septic systems in California are located within the Central Valley Region.

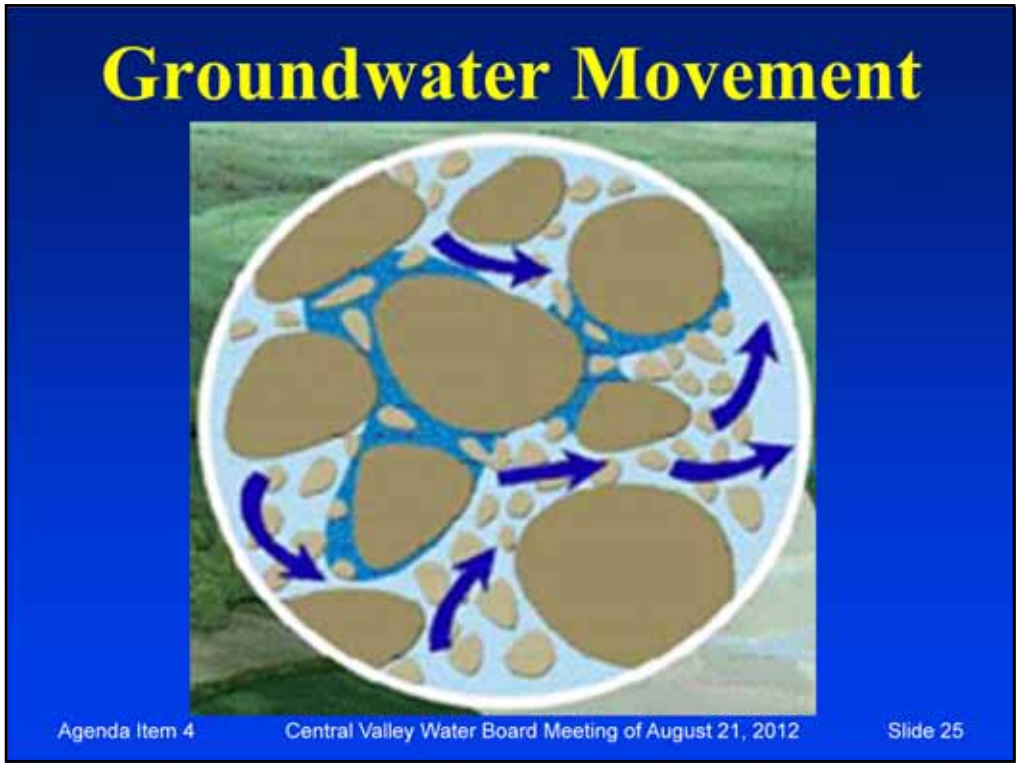
This information emphasizes that groundwater in the Central Valley is an extensively used resource and its continuing ability to meet these needs is critical to the economic viability of the region. By extensively used I want to point out that not only is groundwater used as a water supply, but a significant amount of groundwater recharge comes from infiltration associated with agricultural irrigation and from land application activities the Central Valley Water Board regulates.



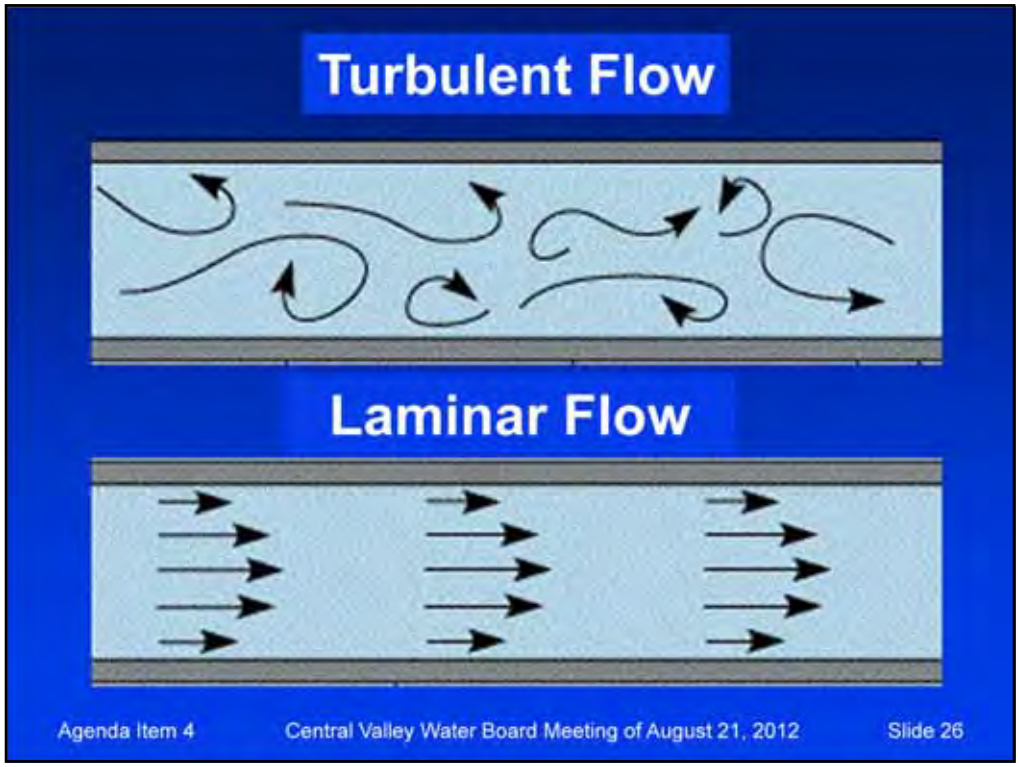
Before I talk about our groundwater programs, I want to take a few minutes to provide a brief review of how groundwater occurs and the distinct differences between groundwater and surface water that leads to the very different manner in which they are regulated.

Groundwater in the San Joaquin and Sacramento Valleys occurs primarily in unconsolidated material or what is referred to as a porous media. These unconsolidated materials are primarily soil and underlying sediment that has not been compacted to the point of becoming a rock and has at times been referred to as dirt. Water occurs in the pore spaces between the grains of what in the upper picture of this slide would be sand. In the foothill and mountain areas of our region, much of the subsurface material is rock and groundwater occurs primarily in fractures, or cracks in the rock represented by the lower picture.

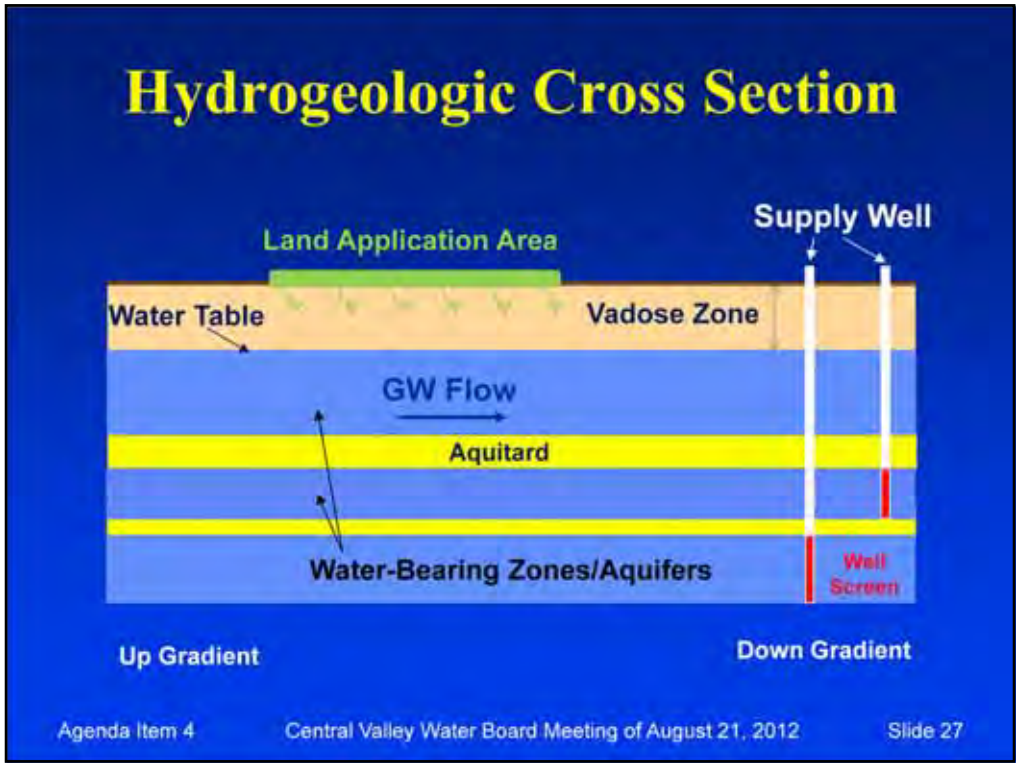
This talk will concentrate on the porous media that occurs within the aquifers of the Central Valley and I will not discuss complexities associated with dealing with fractured rock and leave that for another day.



The aquifers of the San Joaquin and Sacramento Valleys occur when the subsurface soils and sediments become saturated with water. Once saturated, groundwater movement is through the small openings (or pore space) and around the grains as shown here by the blue arrows. This results in significant friction or resistance to flow that results in horizontal flow being measured typically in tens or hundreds of feet per year. Groundwater in the Central Valley because it flows so slowly occurs primarily under what is called laminar flow. This is different than surface water that often occurs under turbulent flow.



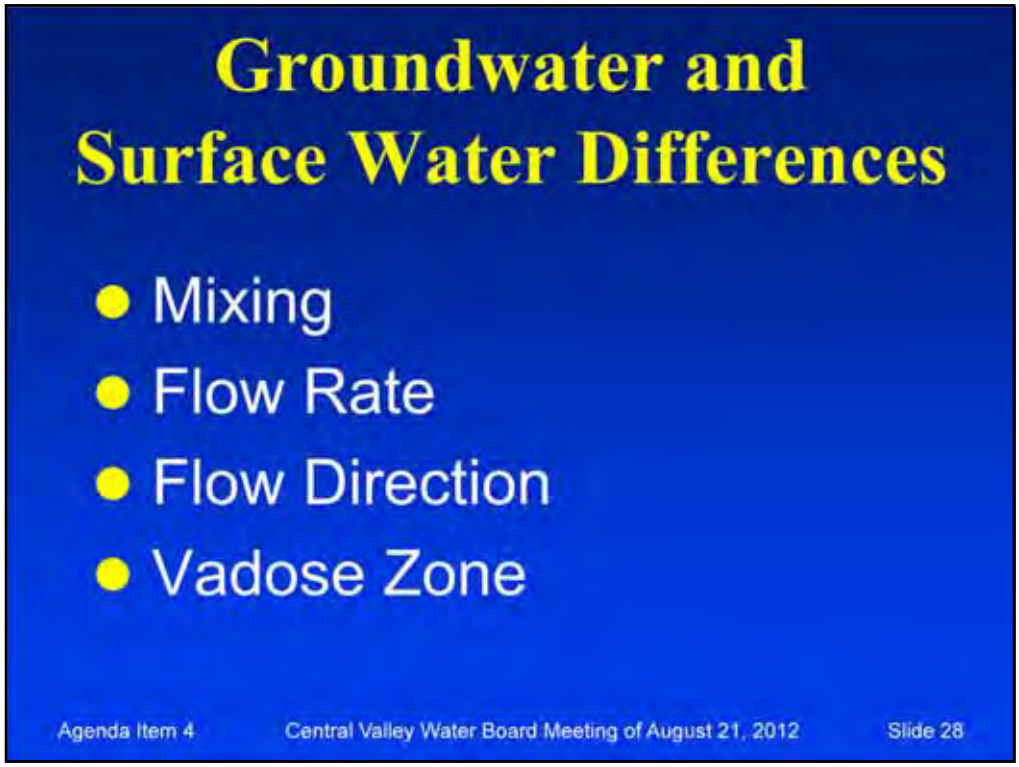
This picture shows the difference between turbulent and laminar flow. The differences most important to this discussion are that mixing readily occurs under turbulent flow and not under laminar flow. Laminar flow is typical of fluids that flow slowly or through a tube with smooth walls. Turbulence occurs under faster flow.



This slide is a hydrogeologic cross section that I would like to use to review some basic concepts. A land application area, in green, is shown at the land surface. This scenario applies to most of our WDR program sites where our agency regulates the discharge of wastewater to land. This would be something like a WWTP or food processor that applies their treated wastewater to land. The green curved arrows from the bottom of the LAA represent percolation into the tan colored vadose zone or the unsaturated zone above the water table here represented by the top of the upper blue boxes. While most of our LAAs apply wastewater to irrigate crops to take up nutrients there is still percolation below the root zone and in the vast majority of LAAs there is a contribution to groundwater recharge. The blue boxes represent different aquifers or water bearing zones that are separated by the yellow boxes that represent aquitards or zones where the vertical or downward flow of water is restricted or slowed. While the flow of water is slowed through an aquitard is almost never stopped. While aquitards are shown in this figure, they are not always present. The direction of groundwater flow is from left to right in the direction of the dark blue arrow in the upper WBZ. What we refer to as upgradient or upstream in the aquifers would be on the left side of the application area and the downgradient or downstream would be to the right of the application area.

While the direction of groundwater flow is shown as to the right, groundwater flow is different than surface water flow that typically occurs within a channel

and is almost always down the channel. In groundwater the flow is variable based on a number of different factors. This factors include recharge which in this slide would occur from the LAA area as water percolates or leaches through the vadose zone. Another issue is discharge from the aquifer that would in this figure occur as the water supply wells are pumped. The different recharge and discharge from the aquifer can cause dramatic differences in the direction of groundwater flow.



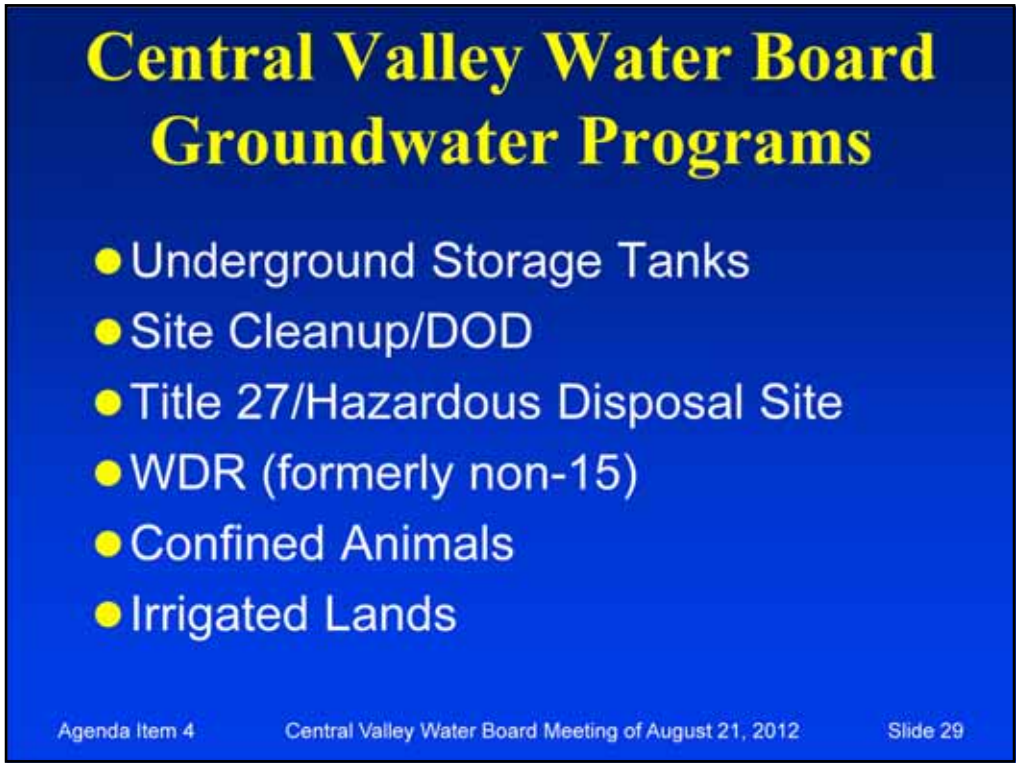
Central Valley Water Board permits typically have different requirements for surface water and groundwater. These are due to physical differences in how these waters occur.

The first is that since surface water often occurs under turbulent flow there is significant mixing that occurs in a relatively short amount of time (minutes to days). The laminar flow of groundwater does not promote mixing and any mixing that does occur is over very long periods of time.

Secondly, surface water in a steam flows much faster than groundwater such that if a surface water problem occurs and the source is removed the water quality issues will be minimized much faster (within hours or days) whereas when groundwater quality issues are discovered, it typically takes years or decades to mitigate the impacts even if there is no continuing source. This is related to the rate of flow and the rate of mixing.

Thirdly, groundwater and surface water flow differently as was discussed a couple of slides earlier. Surface water is typically confined to a channel and except for some extreme circumstances, flows downhill and quickly. Groundwater on the other hand is not typically constrained to a channel and the direction of groundwater flow can vary dramatically because of many factors including such things as recharge from a stream channel that may flow only during part of the year or discharge such as from a large water production well that may only operate during part of the year.

The unsaturated material above the water table is commonly referred to as the vadose zone. There is no vadose zone in surface water. The vadose zone can act as a reservoir when the unsaturated material contains contaminants that continue to leach into groundwater. Depending on the depth to groundwater and the composition of the unsaturated materials, this leaching process can continue for years after the surface activities stop and lead to even longer term impacts to groundwater.



Many programs overseen by the CVWB include requirements to protect and monitor Groundwater Quality. These programs include:

USTs, primarily at gas stations;

Site Cleanup and Department of Defense that include industrial and military facilities;

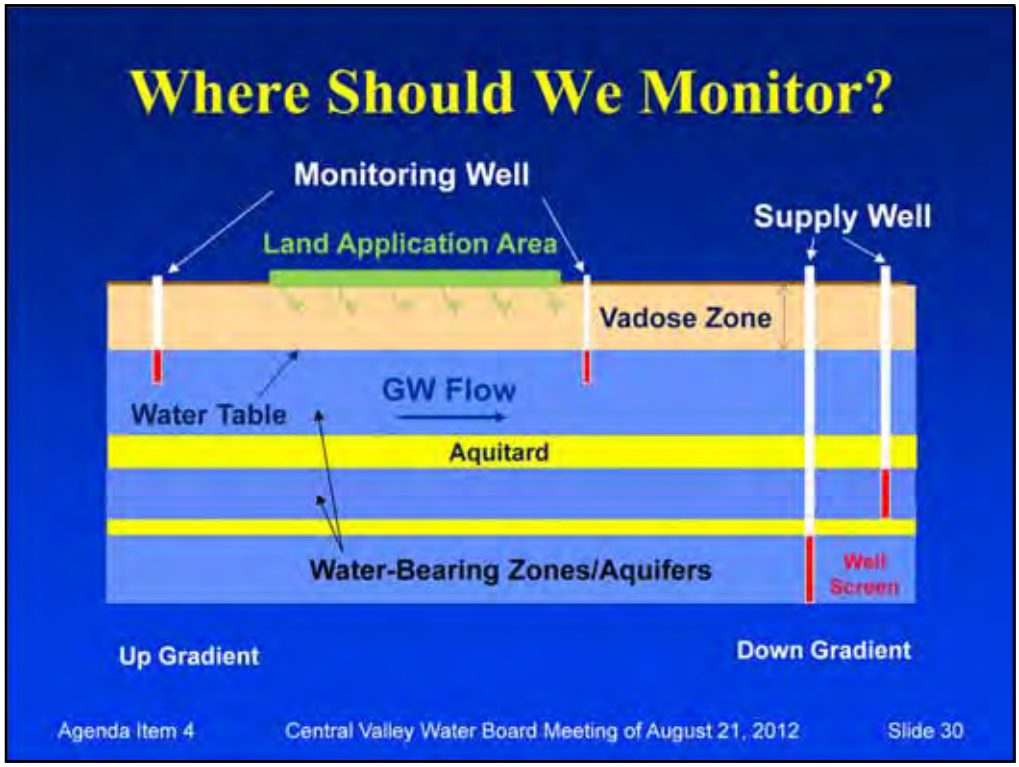
Title 27 Program that includes landfills, certain wastewater surface impoundments, mines, and oilfields.

the Waste Discharge Requirement Program or WDR Program includes facilities that discharge wastewater to land such as WWTPs and food processors;

the Confined Animal Program includes dairies and other types of confined animal facilities;

and now the ILRP proposes to address groundwater issues with the adoption a series of general orders.

Historically, our groundwater programs have required groundwater monitoring at each site with a system custom designed based on site-specific conditions or what I call conventional groundwater monitoring systems.



This slide is similar to one presented a few slides ago, but I want to use this figure to discuss where we should monitor groundwater. Earlier in this presentation, why we monitor was already discussed and I will not repeat that here.

What has been added to this slide are shallow monitoring wells next to the LAA. The other deeper wells on the right side of the figure are water supply wells with well screen, where the water enters the well shown in red in the deeper WBZs. Most monitoring wells are designed to collect water at first encountered water at or near the top of the water table through the well screens. We typically require monitoring of first encountered groundwater because it provides the earliest indication of a problem. Downgradient monitoring wells are located as close to the downgradient edge of the LAA area as possible. In the case of land application areas, and this pertains to irrigated fields as well, water percolates to areas below the root zone and recharges underlying groundwater. As this water is stacked at the top of the water table and moves downgradient the result is that water actually moves at a vector and a shallow monitoring well at the downgradient edge of the filed can sample water recharged from that field.

Upgradient wells are located far enough upgradient to be above the influence of the LAA. Upgradient wells are typically needed to assess water quality before it can become influenced by site activities to help identify any impact as water flows beneath the site and evaluate whether there is an

upgradient source if groundwater issues are identified.

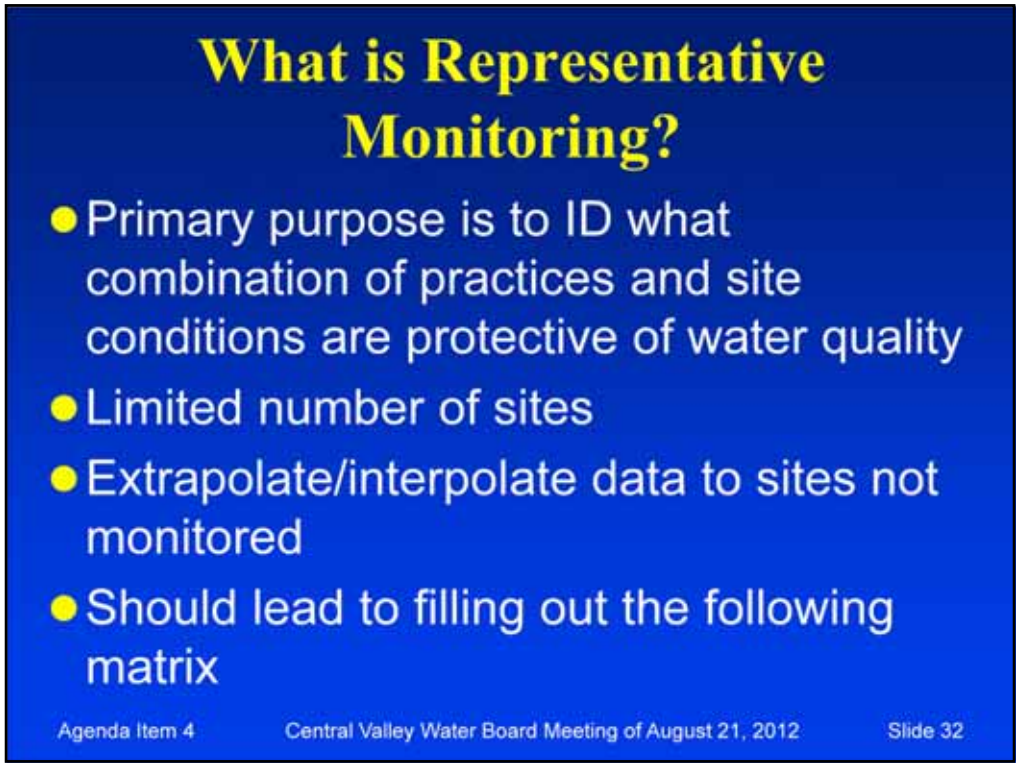
Water supply wells are not typically used as monitoring wells for compliance purposes they have long well screens that typically start below the top of groundwater. This limits our ability to identify the source of any impacts and whether the site being monitored is at fault. Also, the long well screen of a water supply well results in the source area of the water being very large and while suitable for regional studies is not appropriate for site-specific studies. In addition, impacts at the surface would take much longer to be identified to be identified in deeper water supply wells. This delay would prevent us from taking appropriate steps to minimize the impact and would lead to more extensive impacts to water quality and greater potential loss of beneficial uses.

A minimum of three monitoring wells are needed to calculate the slope of the groundwater and allow estimation of the direction of groundwater flow. Many of our sites contain more than 3 wells and the number is dependent on the complexity of the site and increases if wells are installed to assess the extent of impact. Large groundwater monitoring systems can exceed 100 wells.

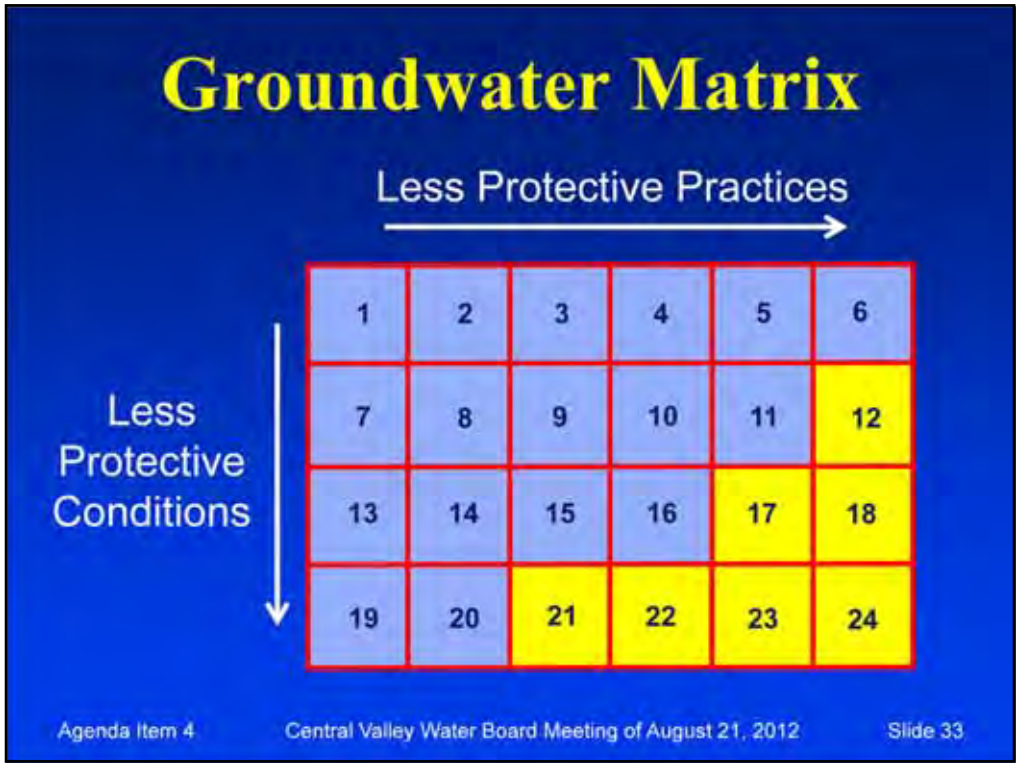
Groundwater monitoring for dairies has taken a different approach from historic approaches employed for facilities where groundwater monitoring is required. Monitoring at dairies is done under two parallel tracks. The first track is monitoring of on-site water supply wells for long-term regional trends and the second track consists of either individual or representative monitoring at the dischargers choice. I am not going to talk about the water supply well monitoring unless there are questions and concentrate on the second track.

For a discharger that chooses to go the individual route, the required monitoring system is very similar to conventional monitoring overseen by the CVWB and talked about on the previous slide. This would typically require the installation of monitoring wells into first encountered groundwater upgradient of the dairy and downgradient of the ponds, corrals, and cropland to identify whether operations at the dairy are in compliance with the General order.

Representative monitoring is a new concept that has been employed at dairies as an alternative to individual monitoring. A coalition called the Central Valley Dairy Representative Monitoring Program has established a RMP and installed over 130 wells at 18 dairies last fall and is proposing to add wells at about 30 more dairies to the system this fall.

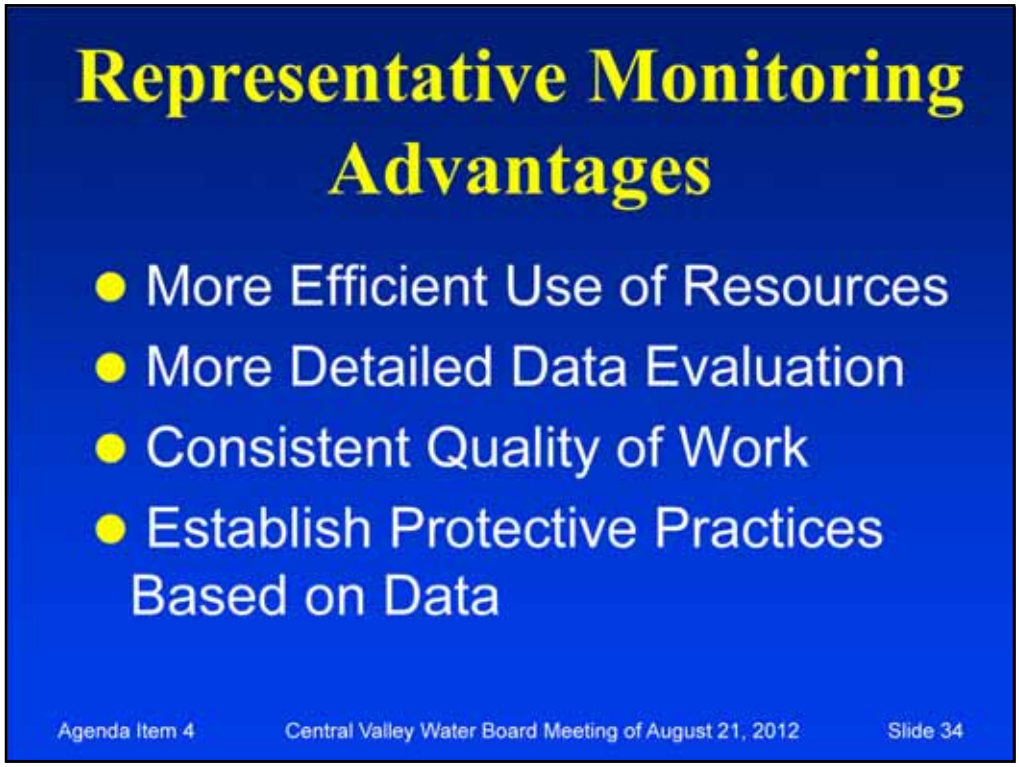


So, what is representative monitoring? Representative monitoring is the monitoring of a limited number of facilities that represent the larger group and taking the information learned on these representative sites and applying it to the facilities not monitored. It is not regional monitoring. This method of monitoring is quite applicable to programs where we have a large number of sites to monitor such as occurs in the dairy and irrigated lands programs. To state what representative monitoring is a little differently, it is the specialized studies of representative sites in leiu of monitoring every site. That information for dairies and irrigated lands is to identify the combinations of management practices and site conditions that are protective of groundwater quality. Once the combination of protective management practices and site conditions are identified or identify what does not work, the information is applied to sites that have not been monitored to identify if improvements in management practices are needed. I can best show how this is done on the following slide.



I call this the matrix. The idea is that the boxes of the matrix represent combination of management practices and site conditions, in this example they are the 24 numbered boxes. Here the blue boxes identify combinations protective of groundwater qualityand the yellow boxes represent combinations not protective. The boxes represent less protective conditions as you move down and less protective practices to the right and results in Box 1 being the most protective combination and box 24 being the least protective combination. This incorporates the idea that there are management practices that may be protective of groundwater quality when the conditions are protective (or less vulnerable to impact), but may not be protective when conditions are more susceptible to impact. As scientists, geologists, and engineers, we can come to agreement on the relative ability of conditions and practices to protect groundwater quality. Basically, something to the effect that we can say that this practice should result in better protection of groundwater than that practice given the other factors are the same. This might be something like saying that lower fertilizer application rates are more protective than higher fertilizer application rates or that deeper groundwater is less likely to be affected by surface activities than shallower groundwater. These comparisons are made with the assumption that other factors are the same. The goal comes in identifying the boundary between the blue and yellow boxes. The end result of this effort would be to apply what is learned to sites not monitored such that sites whose combination is yellow would need to improve their practices to shift them into

a blue square.

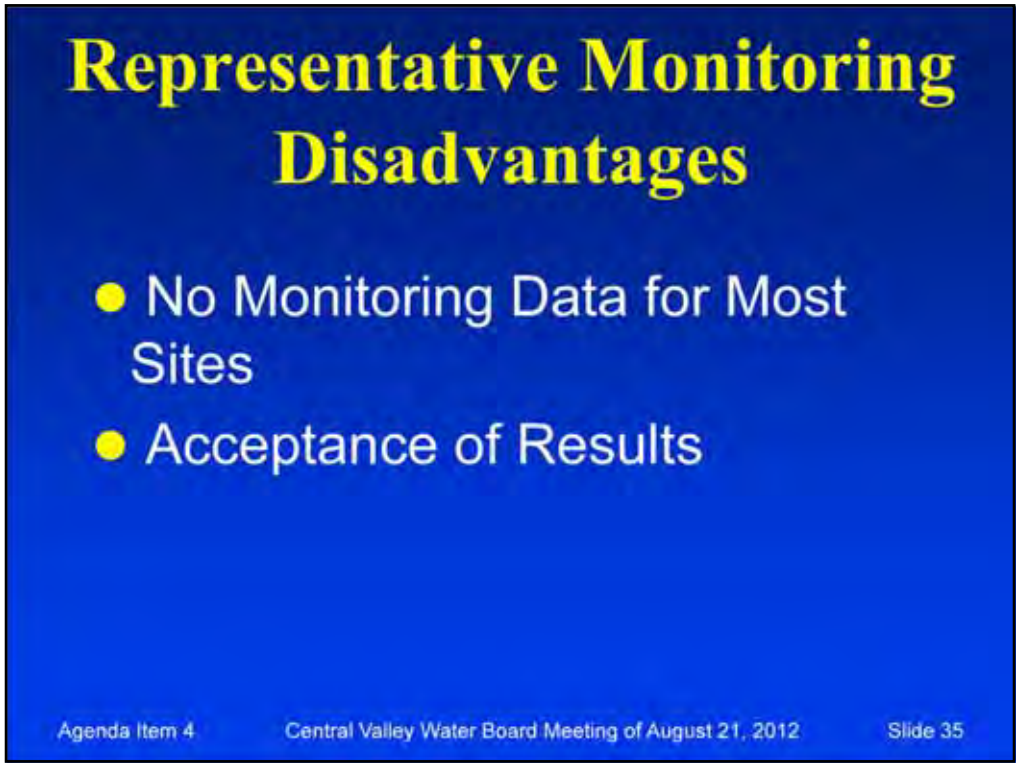


Representative monitoring has several advantages over individual monitoring. These advantages include

More efficient use of resources both time and money. The time issue is true for water board staff as well as dischargers and their consultants. There is less overall monitoring being performed which leads to a significant costs savings to the regulated community in the cost of doing the monitoring from well installation, to sampling, to reporting of the data. There is much less time needed for staff to review a small number of work pans and reports versus the hundreds of work plans and reports that would be submitted under a program utilizing conventional individual monitoring.

This also leads to a more consistent quality of the data which enhances the ability to interpret the data and generates more consistent quality work products. It also enhances the ability to assess differences in monitoring data rather than trying to determine this by looking at a multitude of reports for individual sites.

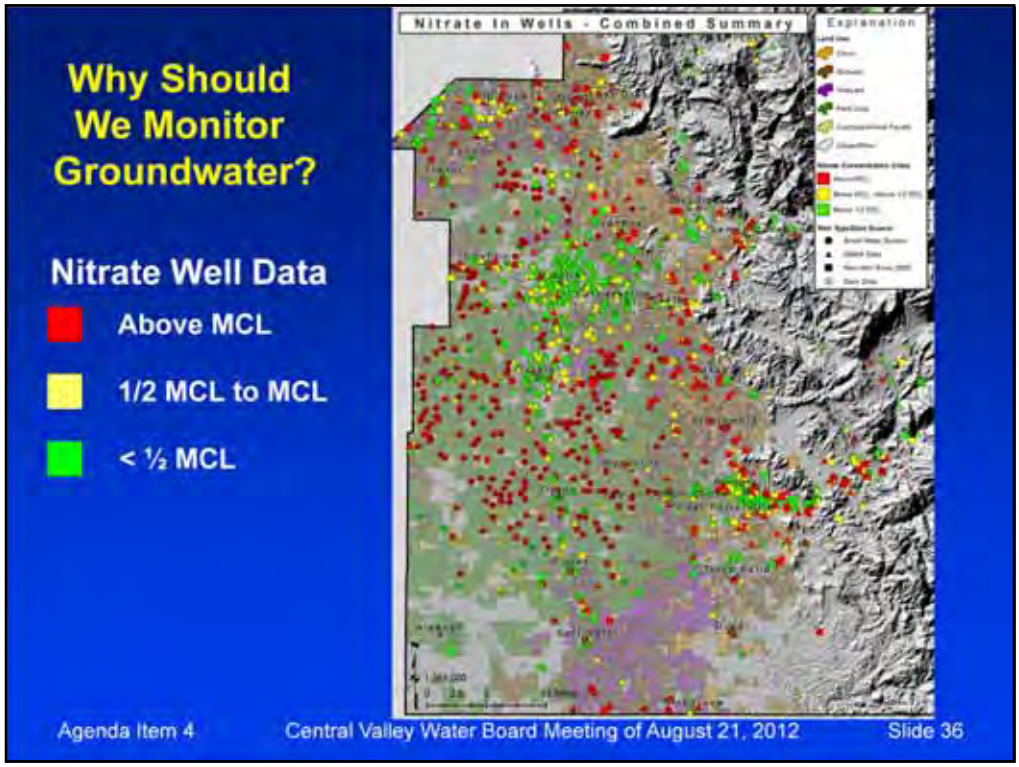
Perhaps one of the biggest advantages is that it establishes what practices are protective of groundwater quality based on hard data.



I do want to point out that there are disadvantages of representative monitoring.

The first of these is that most sites will not be monitored and it takes acceptance by both the regulators and regulated community that the information from the monitored sites can be applied to sites not monitored.

The second of these is the regulated community has to understand that if the results somewhere else indicates that they need to improve their practices, that they are obligated to improve their practices and cannot at the end refuse to make the needed improvements.



As I start to talk about the ILRP, the first question is why do we need to monitor groundwater? Aside from the reasons presented earlier in this presentation regarding compliance with the proposed order and a series of questions developed that will be discussed shortly, the answer is shown on this slide. This slide shows data that staff compiled for wells in Tulare County. Each dot represents data for a well that is either in the Geotracker database, data from DPH, and data from Tulare County and are primarily water supply wells and not shallow monitoring wells. Red dots represent wells where analysis of groundwater detected nitrates at concentrations exceeding the MCL on at least one occasion, yellow dots are for detection of nitrates in well water between half the MCL and less than the MCL, and green dots are where detected nitrate concentrations in well water were below half the MCL. As can be seen from this map, there are significant issues with nitrates in Tulare County. While this area has some of the worst problems associated with nitrates, this problem exists up and down the Central Valley region. Groundwater reports from UC Davis and the USGS indicate that agricultural operations, including dairies, apply the greatest mass of nitrate and appear to be the primary contributor to this issue on a regional scale. There are other sources of nitrate, but they are probably most important on a local scale.

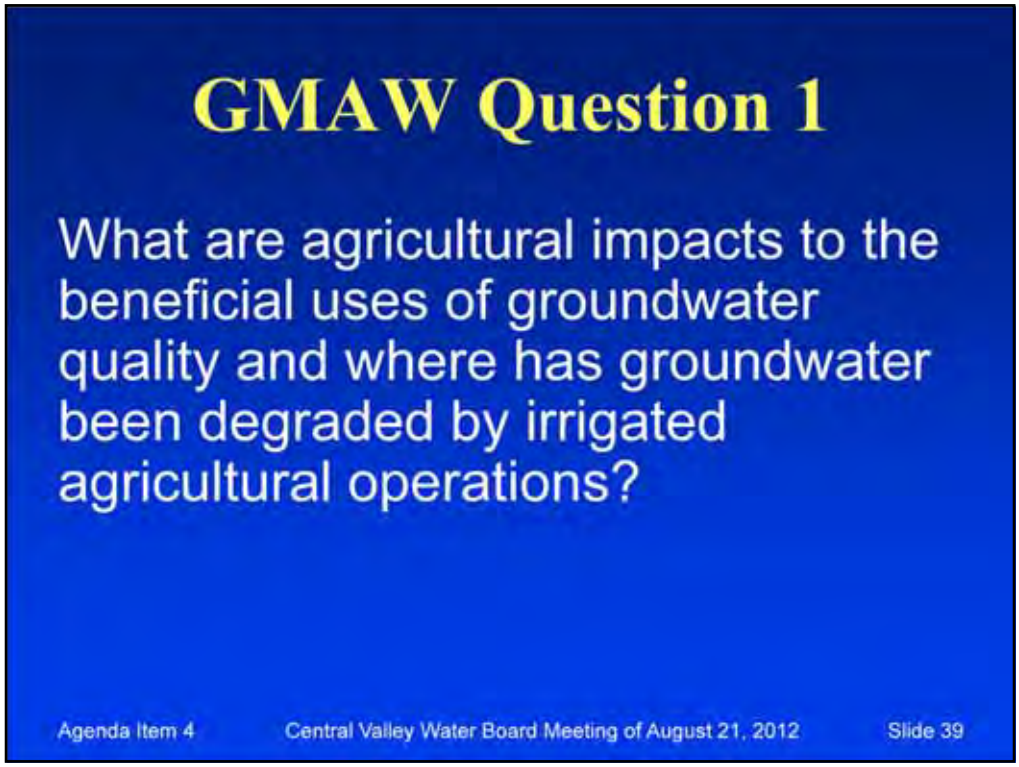
One thing I would like to add is that the majority of these data are for water supply wells, one would expect that nitrate concentrations in first

encountered groundwater will be higher.

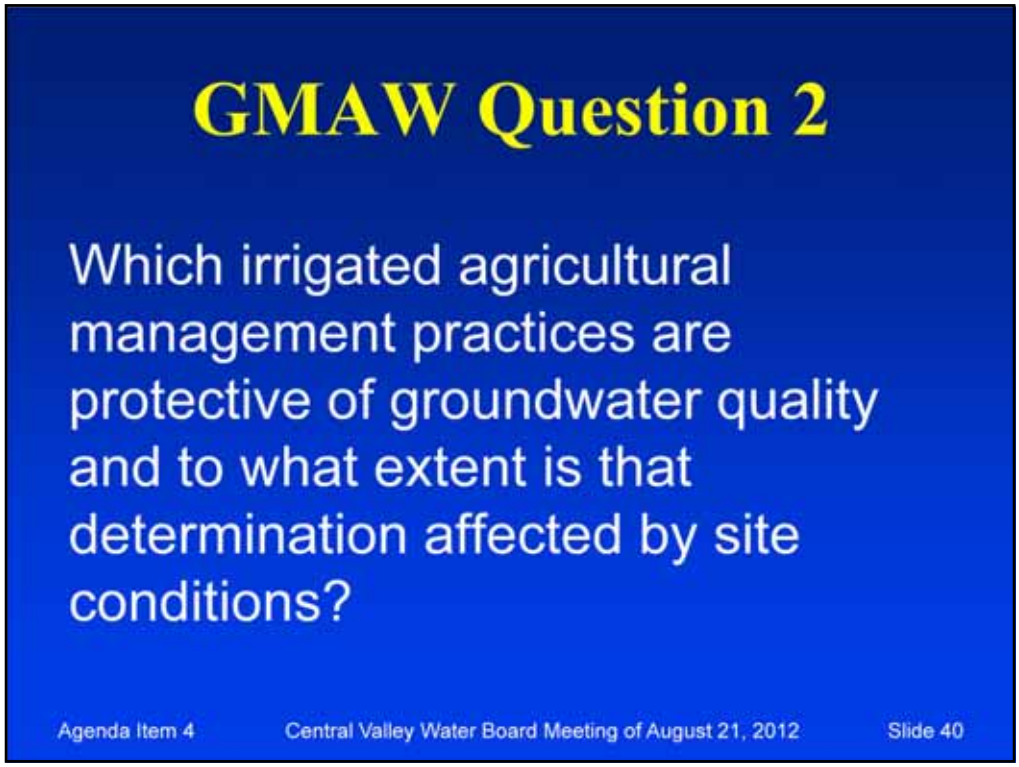
In processes leading up to development of the EIR for the long-term ILRP these goals were developed. The goals are to protect the beneficial uses of groundwater, minimize waste discharge from irrigated land, maintain the economic viability of agriculture, and ensure that discharges from agriculture do not impair the access to safe and reliable drinking water. Monitoring is needed to make sure that these goals can be achieved and identify what (if any) improvements need to be made and where.

A Groundwater Monitoring Advisory Workgroup has been assembled at the request of the EO. The purpose of this group is to assist staff in dealing with complex hydrogeologic issues. This group consists of outside experts representing State Agencies, USGS, academia, and private hydrogeologic consultants. This group meets about every 2 months in this office in meetings open to the public and advertised on our website. This is the group preparing white papers that are described in Action 6.4.2 of the Central Valley Water Board's groundwater strategy.

As we were starting to discuss how groundwater would be addressed in the ILRP, it was decided to engage this work group to assist in preparing critical questions that should be answered by groundwater monitoring. The 7 questions developed are presented on the following slides.

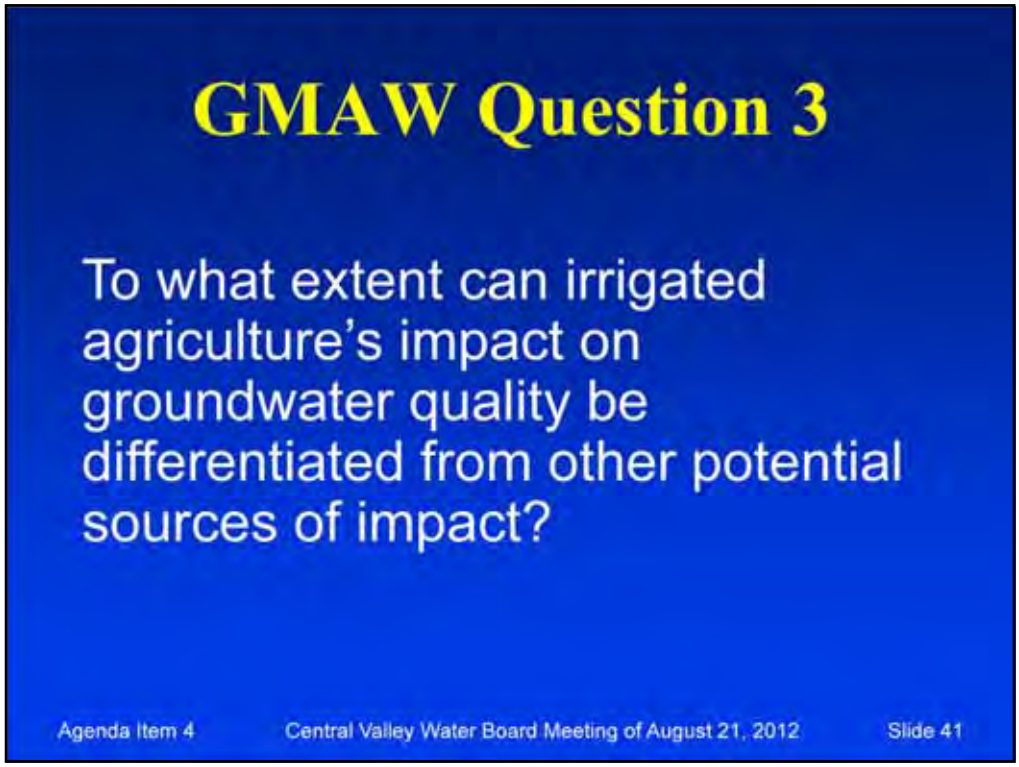


What are agricultural impacts to the beneficial uses of groundwater quality and where has groundwater been degraded by agricultural operations?



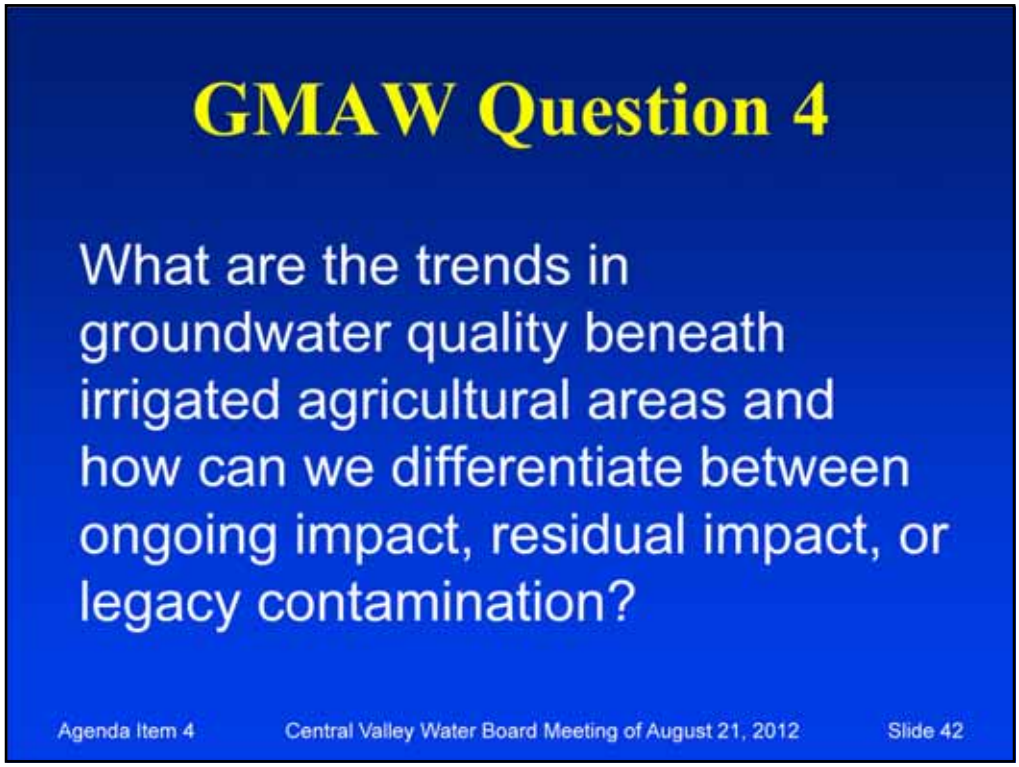
Which irrigated agricultural management practices are protective of groundwater quality and to what extent is that determination affected by site conditions.

By management practices we mean things such as fertilizer application rates or irrigation methods and site conditions would be items such as depth to groundwater or the ability of subsurface materials to transmit water.



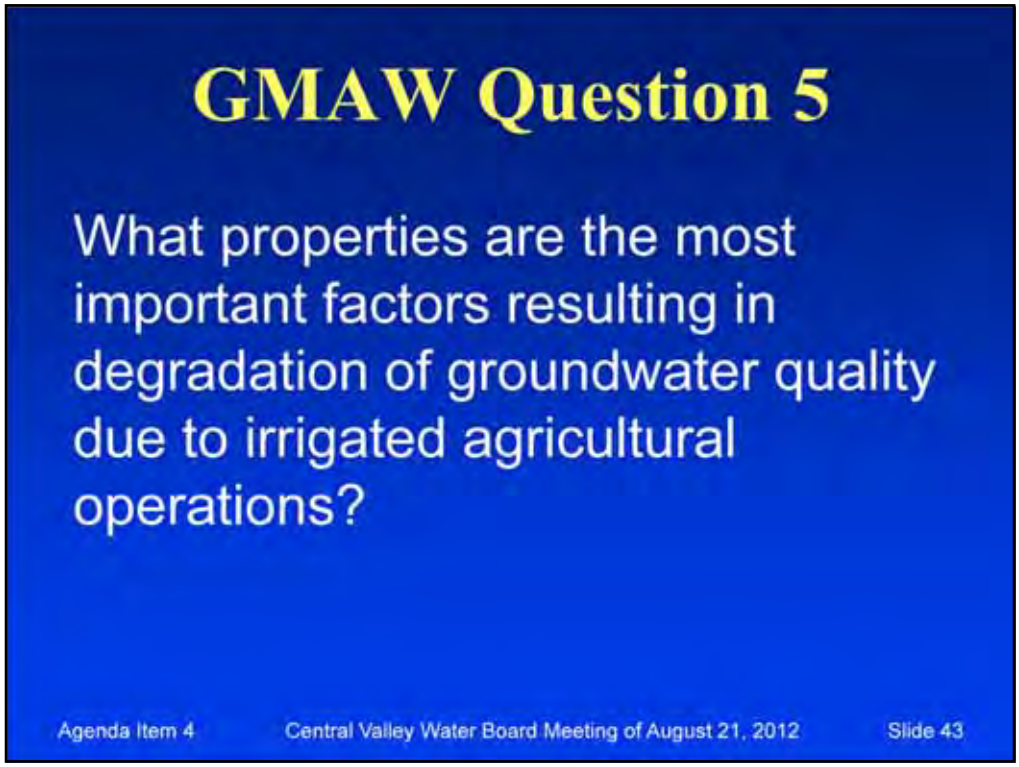
To what extent can irrigated agriculture's impact on groundwater quality be differentiated from other potential sources of impact?

Other potential sources would include, dairies, septic tanks.



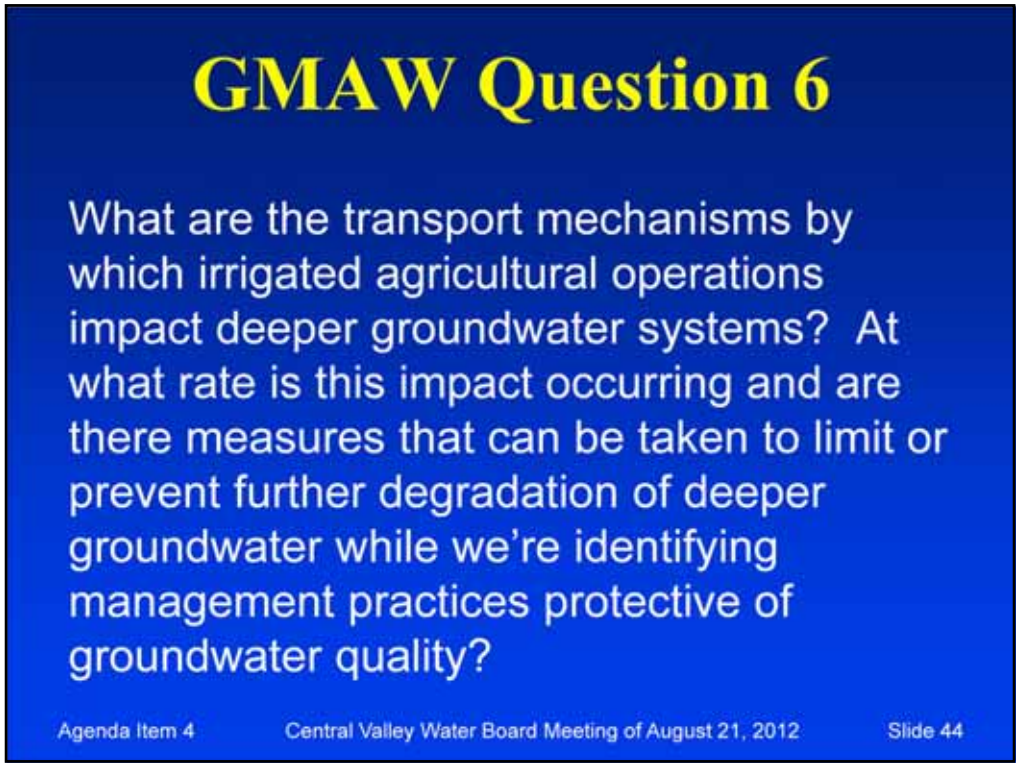
What are the trends in groundwater quality beneath irrigated agricultural areas and how can we differentiate between ongoing impact, residual impact, and legacy contamination?

Residual impact would be continued leaching of contaminants from the vadose zone after surface practices have changed and legacy contamination would be contamination that occurred in the past.

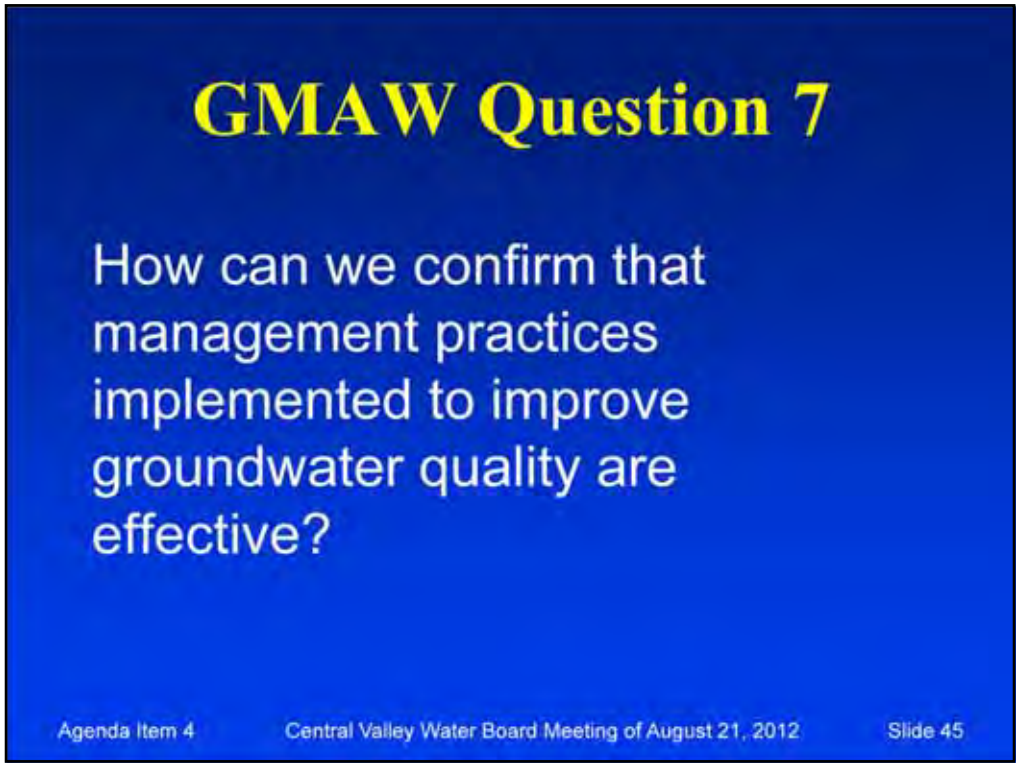


What properties are the most important factors resulting in degradation of groundwater quality die to irrigated agricultural operations?

Properties again could be management practices such as nutrient application rates, preferential pathways such as poorly abandoned or constructed water supply wells or site conditions such as the depth to groundwater, soil types, and chemistry of the vadose zone or shallow groundwater that could cause the loss of nitrates.



What are the transport mechanisms by which irrigated agricultural operations impact deeper groundwater systems? At what rate is this impact occurring and are there measures that can be taken to limit or prevent further degradation of deeper groundwater while we are identifying management practices protective of groundwater quality?

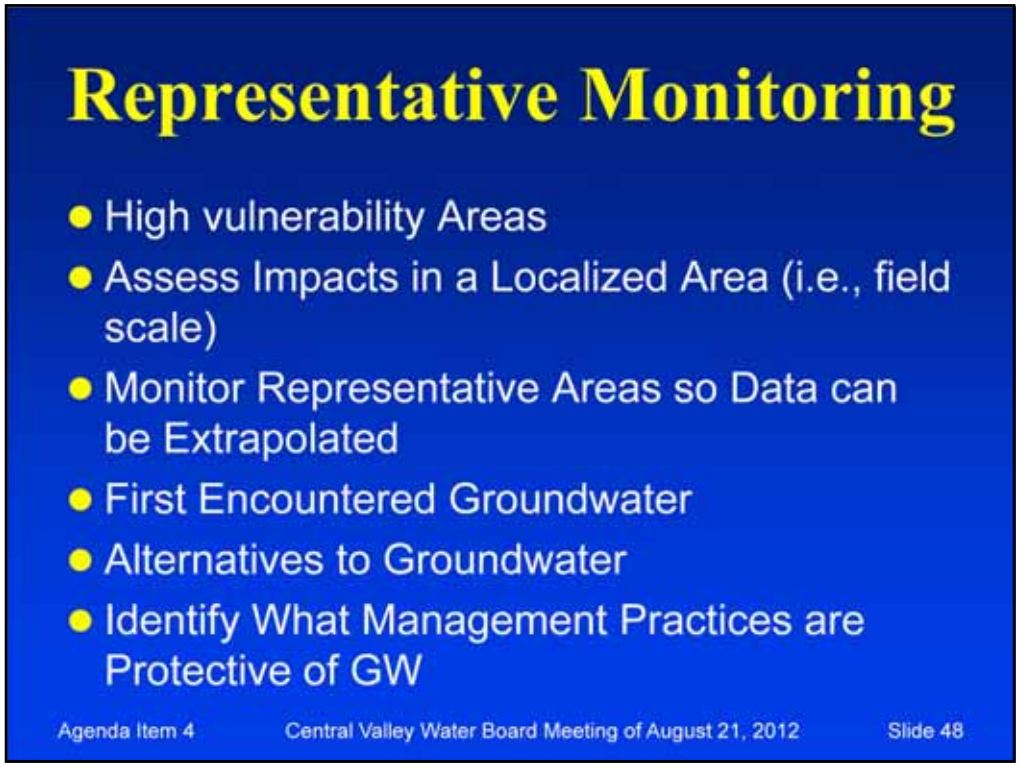


How can we confirm that management practices implemented to improve groundwater quality are effective.

To address the questions developed by the Groundwater Monitoring Advisory Workgroup, staff is proposing two parallel tracks of groundwater monitoring. These are trend monitoring and representative monitoring. I will elaborate on these in the following slides.

Trend monitoring is proposed to entail monitoring of a limited number of water supply wells to assess regional trends in waters that are being actively used. This would ideally be shallower wells where the construction is known. We are recommending shallower wells because they are most susceptible to water quality problems and effects would be observed sooner than in deeper wells although improvement in water quality caused by improvements in management practices may not occur for years. This would be done in high and low vulnerability areas. The value in low vulnerability areas is to confirm that problems are not present or identify trends that would indicate significant issues are coming. The value in high vulnerable areas would be to confirm that implemented management practices are leading to long-term improvement in groundwater quality.

It is proposed that trend monitoring would be established by each coalition following submittal of a work plan identifying the wells to be monitored, frequency of the sampling, and analyses to be performed. However, if coalitions wanted to work together and propose trend monitoring at a scale larger than an individual coalition, it is anticipated that that approach would be acceptable.



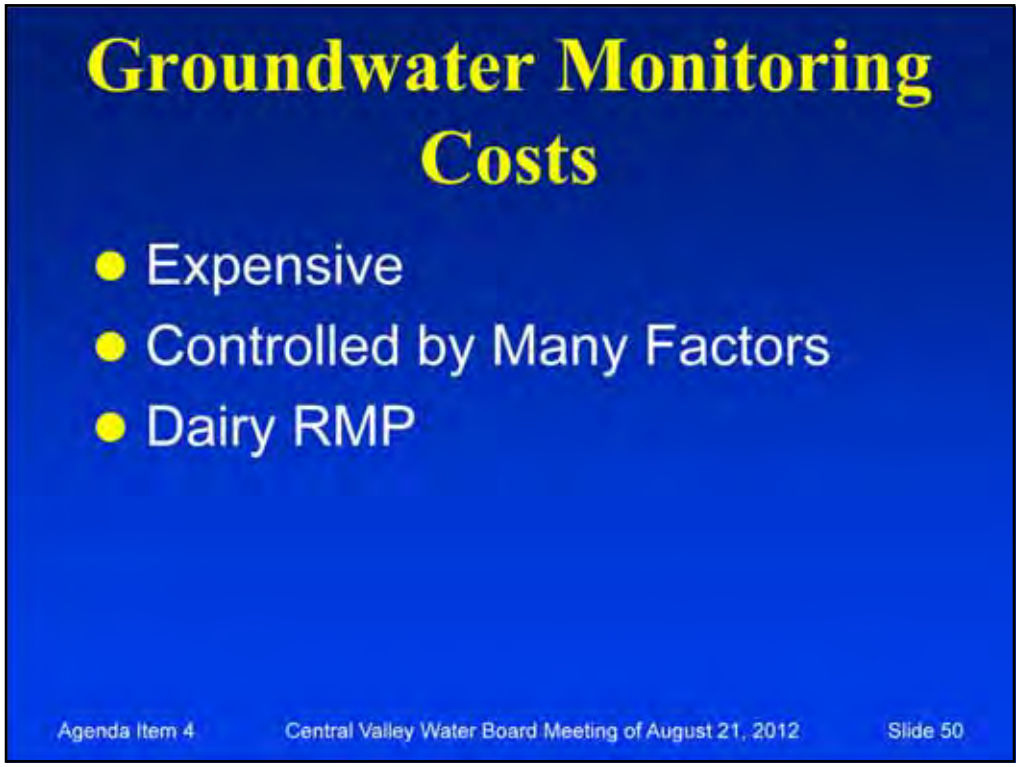
The second track is representative monitoring very similar to what the dairies are currently doing. This is proposed in high-vulnerability areas only. The proposed representative monitoring would assess data at the field scale to allow extrapolation to fields not monitored in the same fashion as the RMP for the dairies. It also would require installation of monitoring wells at first encountered groundwater to allow identification of the sources of the water being sampled, and allow evaluation of whether existing practices are protective and for areas where changes are made to assess the impact of those changes in management practices at the earliest possible time. Staff has also been approached about alternatives to groundwater monitoring to answer these questions. One example of this might be vadose zone studies to identify what is leaching out the bottom of the root zone combined with numerical modeling to evaluate the potential impact to groundwater. Staff is amenable to alternative approaches; however, in the vadose zone example some groundwater monitoring is likely to be required to confirm that the modeling can accurately predict the impact to groundwater quality.

Similar to the dairy RMP, a groundwater matrix or some other type of tool would be used in to identify the combination of management practices and conditions that are protective of groundwater quality and also identify where changes in management practices are needed.

Representative monitoring is the most critical part of the proposed groundwater monitoring program. This is the monitoring that identifies what

needs to be done to protect groundwater quality to help ensure that in the long term groundwater quality is protected.

Staff has been recommending a cooperative approach to implement representative monitoring. Staff met with representatives of the coalitions and suggested they should work cooperatively to implement this program rather than each 3rd party group working independently. It makes sense that data collected within a 3rd party area could be applicable to the region or commodity and working cooperatively would minimize any overlap and duplication of effort. This could lead to substantial cost savings.



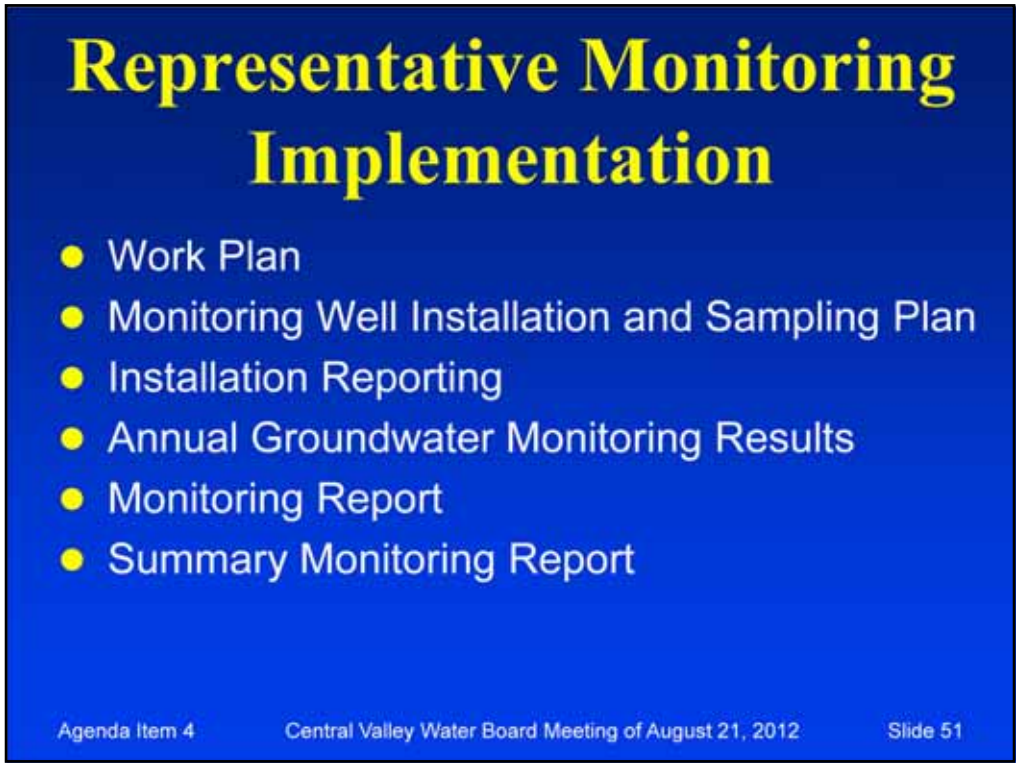
Groundwater monitoring being proposed for the ILRP will be expensive and everybody wants to know how much it will cost. That depends on a lot of different factors. These factors are mostly related to how the problem is approached. For instance does each coalition decide to take their own approach or do they work together and answer the questions 1 time for the region.

I can tell you what the dairy industry has done to provide a rough idea. The dairy program has spent on the order of $2,000,000 to over the past couple of years to get the CVDRMP set up and do the first phase of work. $1,000,000 of this came in a grant from the NRCS. The CVDRMP has about 1300 member dairies that are charged $81/month to be in the program and that is in addition to a membership fee that most joined at a cost of $500. I was told that they do not forsee having to increase the rates that generate on the order of $1,250,000/year to cover the cost of the program. The irrigated lands program will be larger because there are 33,000 farmers on 7.5 million acres growing in excess of 250 different crops. However, what should be assessed is not necessarily the number of crops, but the management practices and many crops have similar management practices allowing lumping of different crops into a manageable number of groups. The bottom line is that dairies are fewer in number growing a smaller number of crops, but their site specific monitoring systems are larger because they have production areas and ponds to monitor in addition to the cropland. All

this said, a RMP for the ILRP in a best case scenario might be about the same size or a little larger than the dairy program and at worse case might be 5 times larger, so that leads to a range of costs on the order of 1.5 to 7 million $/year. Assuming the costs were spread over 7.5 million acres the ballpark costs would range from about 20 cents/acre to slightly less than $1/acre/year.

Based on my conversations with industry representatives and written comments we have received, a concern is that they do not know what this will cost. If the coalitions want to know what the specific costs will be, they need to submit their workplan and get it approved. Once there is a workplan the costs can be estimated and would include any variations such as alternative approaches.

In addition, the dairy and ILRP RMPs need to cooperate as I would think the dairy information for cropland would be of value to the ILRP RMP.



This slide is intended to present how representative monitoring is proposed to be implemented in the ILRP general orders that will come to this board for consideration.

The first step of the process is submittal of a work plan detailing what they plan to do.

Following approval of the work plan by the EO, a Monitoring Well Installation and Sampling Plan would be submitted proposing how the monitoring wells or other sampling devices are to be installed and how the samples are to be collected.

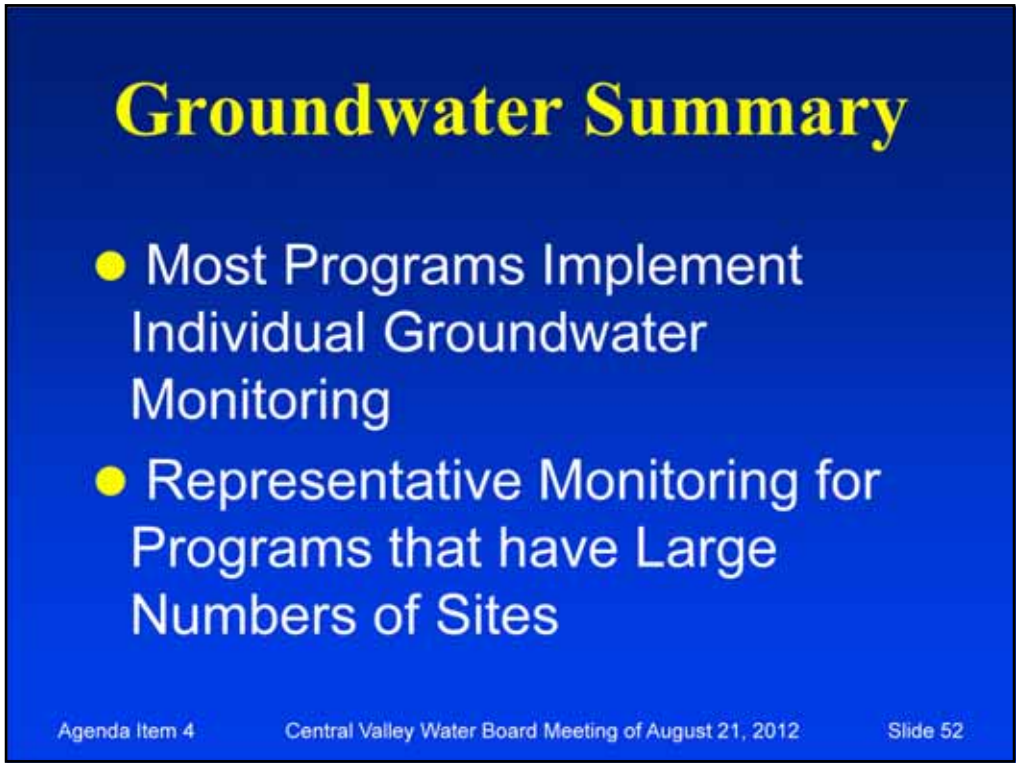
Following installation of the monitoring wells or other sampling devices an installation report is needed to document the work performed.

Each year, the 3rd party would submit results of the previous calendar year monitoring data. This is proposed to be submitted electronically to staff and the Geotracker database.

Every 2 years the 3rd party would submit a Monitoring Report. With respect to groundwater, this report would present the data collected to date, evaluate the data, and summarize any actions taken to address exceedences of WQOs.

Six Years after implementation of each phase of the RMP, the 3rd party is to submit a Summary Monitoring Report. The summary report is to identify management practices protective of groundwater quality for the range of site

conditions covered under this phase of the study. If practices being implemented are found to not be protective of groundwater quality for some of the combinations of site conditions covered under this phase, the 3rd party shall propose and implement new practices to be implemented at the monitored farms to assess the effectiveness of the new practices. The proposed orders require irrigated agricultural operations to implement management practices protective of groundwater quality.



In summary, most of the programs that include groundwater monitoring overseen by the Central Valley Water Board implement conventional individual monitoring. For programs that have 100s or thousands of sites, such as dairies and being proposed for irrigated lands, we are implementing representative monitoring as an alternative to doing monitoring at each facility. This is a cost and time effective method to collect the required information and identify what needs to be done to protect groundwater quality. The trend and representative monitoring being proposed for the ILRP are based on collecting the data needed to answer the critical questions identified by the GMAW and staff and help ensure the goals of the EIR are met.

This concludes my presentation and I am available to answer any questions.