Sustainable River Basin Management

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Module 3- 2

Lecture - 22

Part 02

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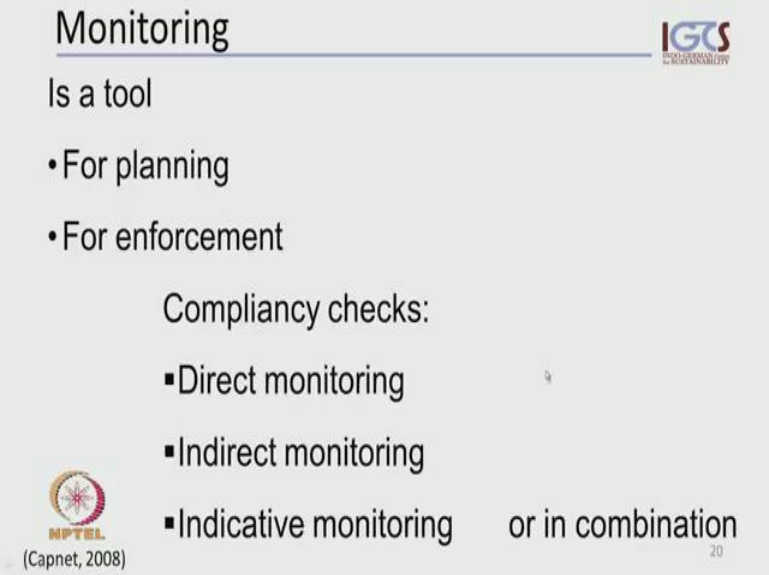

Welcome everybody to Sustainable River Basin Management, module three-two, part two. This time I am going to speak to you about monitoring. Now, monitoring is a tool and that tool serves planning and it also serves enforcement. These are the major objectives of monitoring and what we want to achieve is the enforcement monitoring as compliance checks. You want to conduct direct monitoring, indirect monitoring, indicative monitoring or in many cases, we combine one or two or more of these major objectives in one exercise of monitoring.

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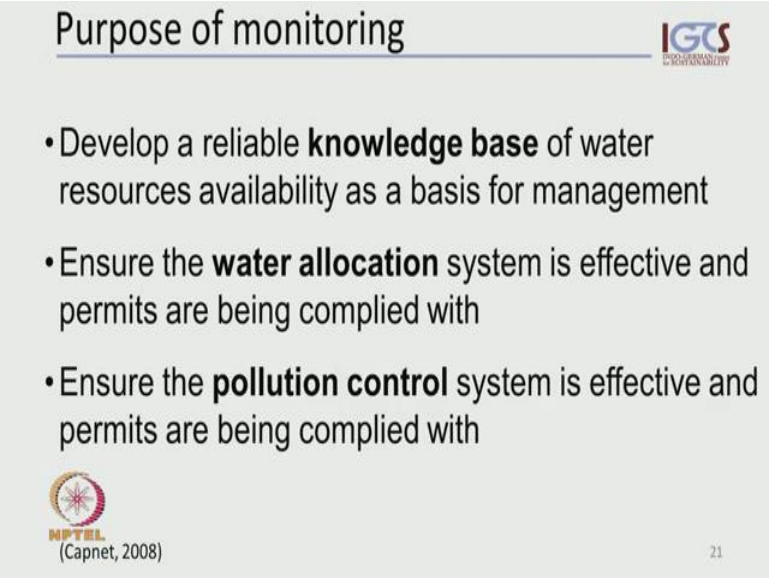

Now, the purpose of monitoring is to develop a reliable knowledge base of water resources availability as a basis for management. So, first of all, we need to have our background data. We need to monitor what is going on over range of time, range of space to be able to come to our water budgets, which serve as a basis for water allocation for water management. And then, we have to ensure, that water allocation systems are effective and permits are being complied with.

So, the two major objectives, clearly one varying on the other, but one already going to allocation and into financial sustainability and economic sustainability of water. And the third one is to ensure pollution control and we have the system in place that is effective. And again, there are permits attached to the pollution control monitoring, which are complied with. So, those are the components.

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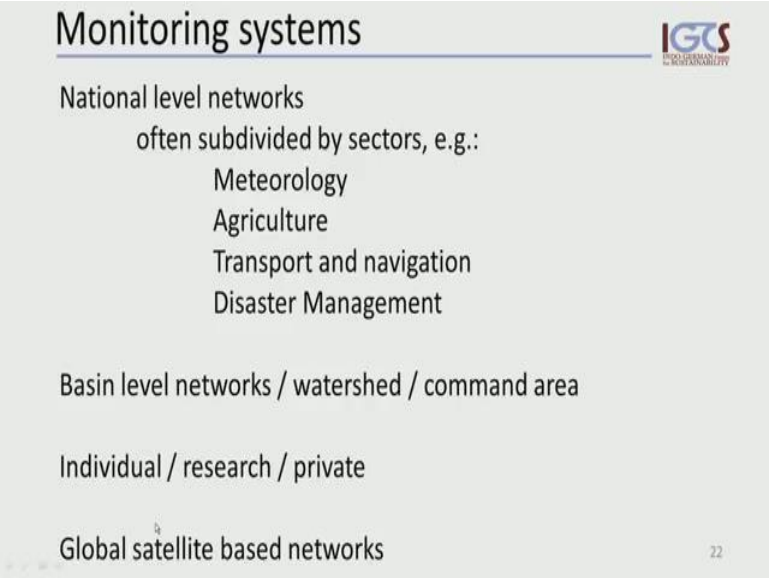

The monitoring systems are often divided into or distinguished into three levels. First of all, the national level networks, which in most of the cases most of the countries are subdivided by the sectors. All of those run their own national level networks, for instance, the meteorological services, the agriculture departments or ministries, transport and navigation, the airports, for instance, run their own systems, disaster management and there may be many more running their own networks.

Then, we have basin level networks, which cover certain parts of river basins or entire river basins, water sheds or just command areas on the agriculture usage, the irrigation respective of the system or hydropower management perspective of water sheds. And then, we may have this lowest level of these monitoring systems individual or research driven monitoring networks even private networks as in the case of forestry plantation or large farming corporations having their own monitoring systems. And then, we have one outside, standing outside, state boundaries and those are global satellite based networks, which increasingly becoming important.

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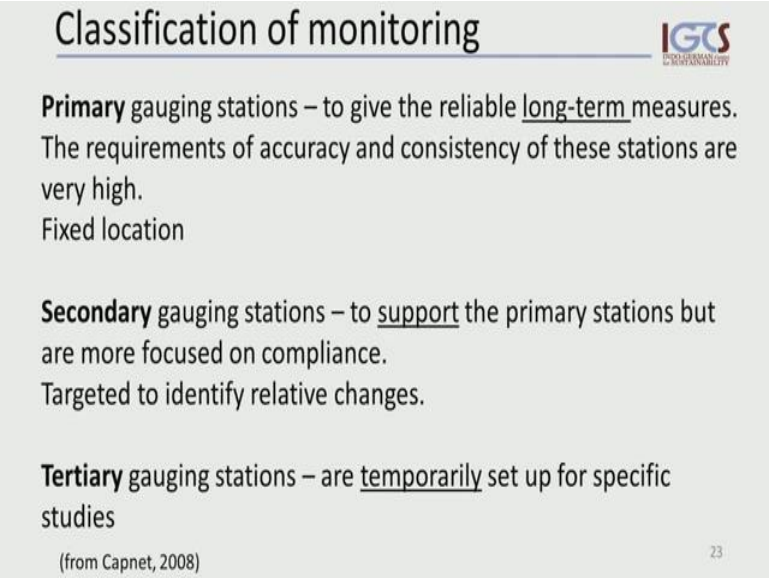

Now, we can classify monitoring into the primary gauging stations. The purpose of these primary gauging stations is to give reliable long term measures and this requires what is expected from these primary gauging station is accurate and consistent data over a long term range. So, this also means, that primary gauging stations are supposed to have a fixed location or not move because of large infrastructure projects. For instance, those are spaces, which are ((Refer Time: 05:03)) and fixed so as to allow long term records to be collected from under one and the same landscape conditions. Very often, this is not simple because in many cases, this is simply not seen as very important, but are primary gauging stations being maintained in some other interest in terms of land development are at stake.

Then, we have secondary gauging stations. Those are seen to support primary stations. They focus more on compliance monitoring. ((Refer Time: 05:46)) secondary gauging stations, we primarily want to achieve change detection. So, when we look at compliance, we can more easily detect violation of compliance detecting changes in certain parameters. And then, tertiary gauging stations, which provide or consider to be temporary set up and serves specific studies only.

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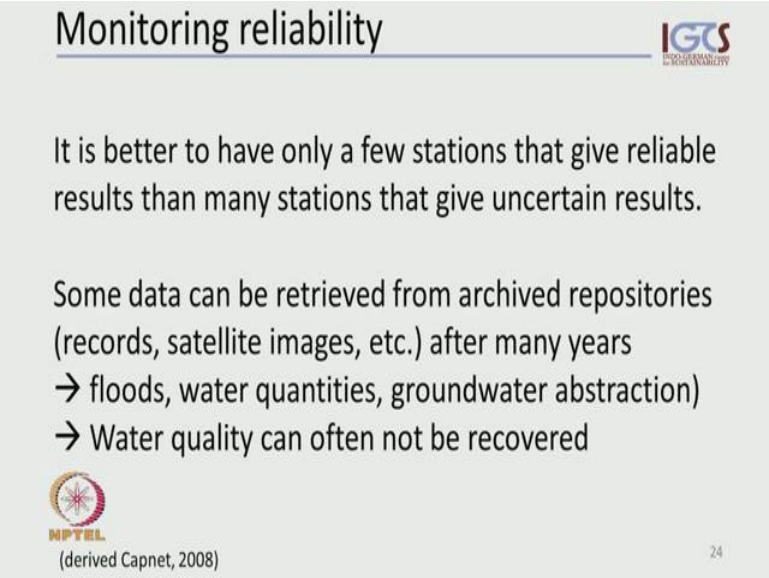

Now, let us look into the monitoring reliability. It can be understated or not stated often enough, but it is better to have only a few stations, however stations, that give reliable results than aiming at many stations and obtaining uncertain results. So, if efforts are made and only resources, resources are very limited, it is better to put those efforts into a fewer stations rather than forcing a collection or setting up many or putting many resources into the station, set up installations and then not being able to collect data at a regular and qualitatively good standard.

Now, someday that can be retrieved from archived depositories even after many years and that is quite important also in making the decision of how many stations and where, which part to invest when we want to obtain a reliable long term monitoring data. We can obtain records form archives, from satellite imagery, which can give us information on flood events for instance and water quantities. We can obtain even after many years of information or data from about groundwater abstraction. What can often not be recovered is water quality data and that is why, I want to underline the importance of water quality monitoring in the first place.

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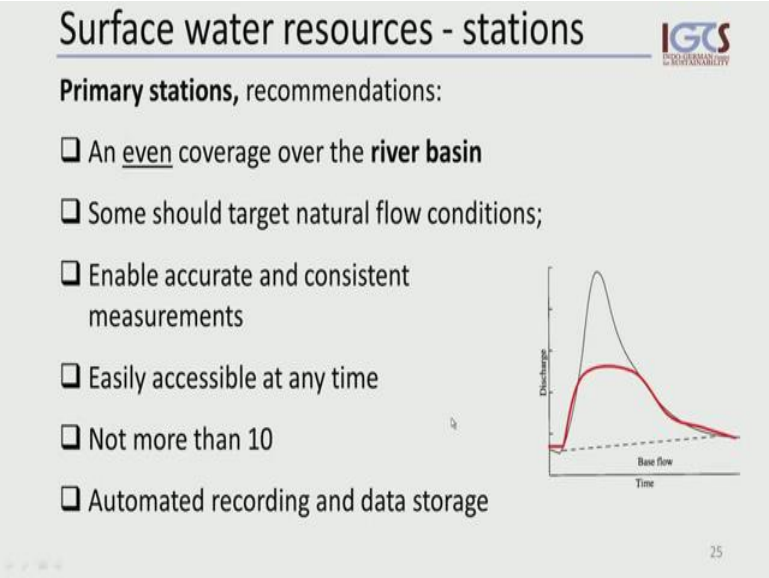

Now, let us look into the surface water resources and stations. The primary stations, that is our recommendation in a perfect road, should have an even coverage over the entire river basin. It should also target natural flow conditions and it should enable accurate and consistent measurements. It should be easily accessible at any time throughout the year that should be a limited number, if possible should be not more than 10 stations and very optimum would be automated recording and data storage facilities, which would relieve the human factor or risk with human factors from the readings.

Let us just reflect upon this. This is a typical discharge curve we obtain here. The discharge and the amounts of discharge taking place over time and the difference between an automated station and human or manual reading, one person is going to specific predetermined times and collects the data records and fills in some forms is exactly research. We may only be able to capture part of this search event, whereas the real discharge might have occurred during a time when no recording is taking place. So, this is one of the reasons why this automated recordings are so important and the data storage is so important.

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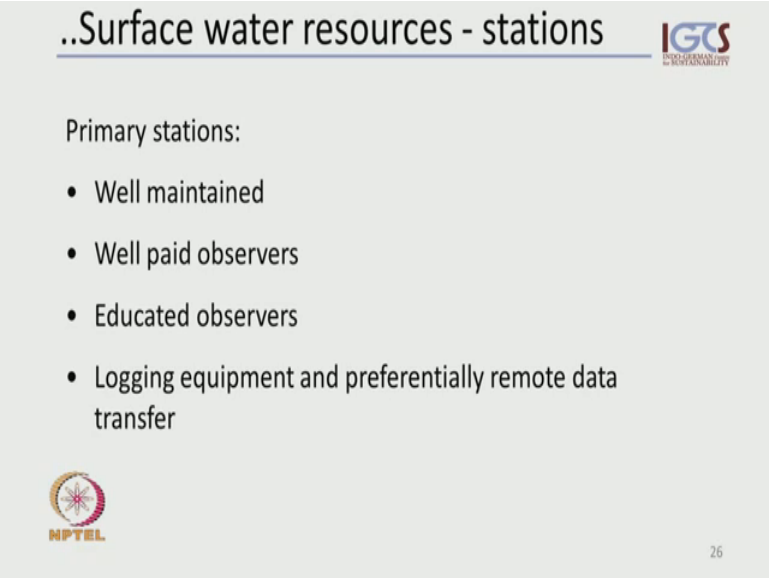

Now, let us continue on this surface water resources stations and besides the scientific reasons of setting up primary stations. The additional points to that, which have to do is the manpower and the resources that should go into this. There should be a budget for maintenance. So, those stations need to be well maintained, must be a budget available to pay the observers those on which we rely for the data recording.

Those observers for primary stations need to be educated. They must be able to understand what they are doing, to report in time to be able to write and monitor changes also and inform about changes and there must be funding available for data log, logging equipment, and there should be a preferentially remote data transfer available so that under extreme levels, information data can be made available at the data decision making points, which may be quite far away from the station

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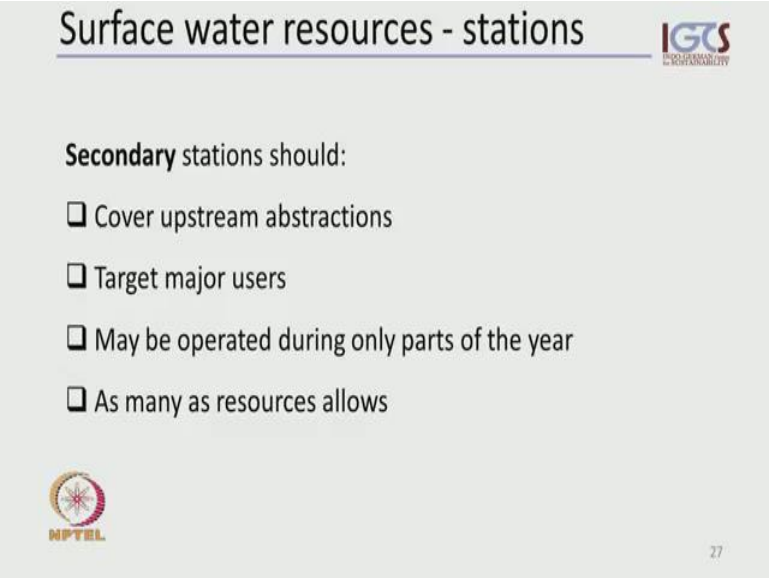

Now, this is about primary stations, let us look into the secondary stations and their conditions. They should cover mostly upstream abstractions; they should target the major users. They may be operated only during parts of the year when major abstractions are taking place. For instance, for irrigation or for mining and the resources can be allocated as they are available or as the need is coming up for these compliance monitoring programs.

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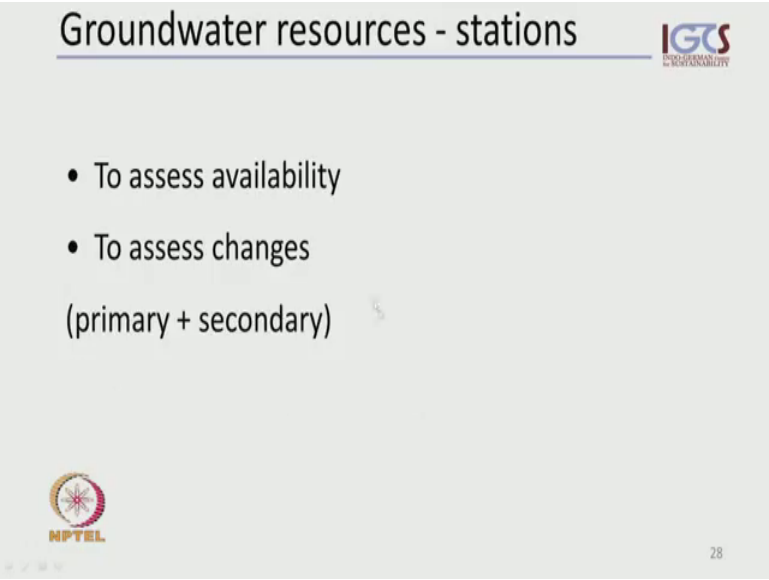

Now, having talked about surface water resources, let us quickly touch upon ground water resources monitoring and there are two major purposes for that. First of all, to assess availability is that ground water in which quality and quantity is that water available and to assess changes. These are the major points for which primary and secondary monitoring points are set up for ground water and the rest supply is set for the surface water stations.

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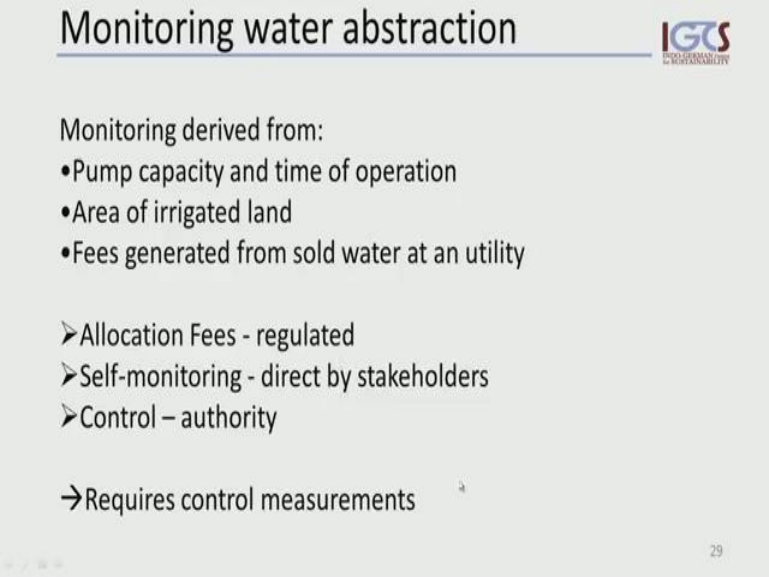

((Refer Time: 13:07)) some component, which is important, which is about water abstraction. So, when we talk about water allocation we also need to be able to monitor how much of water has been abstracted to make sure that what has been allocated is indeed the amount is being abstracted and used and for that, the monitoring data is derived from the pump capacity and the time of operation of the pumps. It could also be derived from the areas under irrigation and it could also be derived from the fees, which are generated from selling water at water utility. So, those are indirect measures, measurements of water abstraction, which help us monitor compliance.

Then, there are three forms of funding this. One is though the allocation fees, which could be regulated, which could be a self-monitoring, means, means, that stakeholder, farmer or major water utility is monitoring its own water abstraction and reporting back to about it and paying accordingly or the control or compliance done by an agency or a water authority or some contacted auditor from the outside. All of this requires control

measurements. Even if the self-monitoring is in, is working well, even if the authorities are doing good monitoring, it requires control measurements, which should be independent from the three of those.

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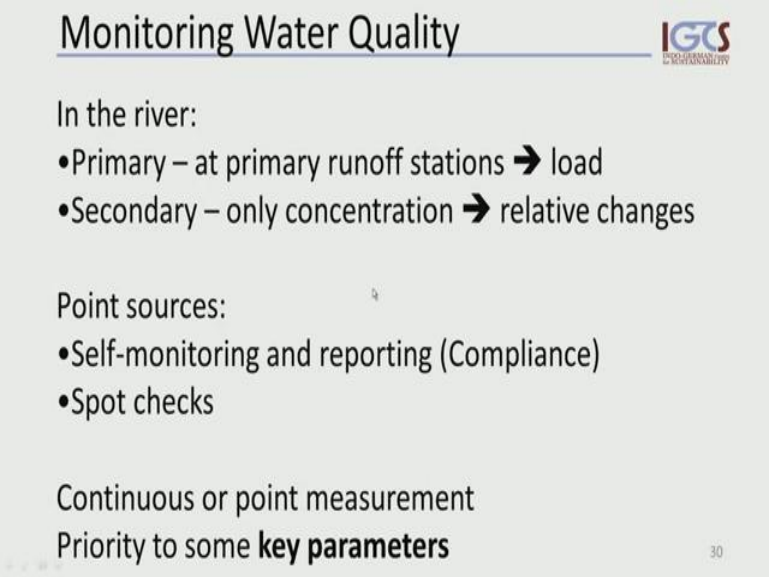

Now, let us look into the water quality aspects. First of all, we measure water quality in rivers, in primary stations or primary networks and what we measure there is load of certain, certain elements or certain chemicals, of certain, of sediments, so on. So, that is what we want to obtain from a primary network.

From a secondary network we will only be collecting concentrations and those are relative changes. This gives us only information on relative changes because as you can imagine, concentrations will likely increase at low flows and dilute the low at high flows in a river. So, this will not tell us exactly what is going on in terms of water quality and ((Refer Time: 16:19)) of those will give us details of information in terms of water utilization or possibilities to use the water on a downstream end and monitor what is going on in the upstream part.

Then, we have a point source water quality monitoring that could be a self-monitoring and reporting scheme of a company. For instance, farmers or individuals that could be on the compliance and there would be spot checks that in a way, infrequent way, somebody would come and conduct measurements and check if everything is in within range or not. And those spot checks would usually take place during times when operations are may

be not going on or certain operations are operated are working. For instance, the application of fertilizers during a certain period of the year or application of pesticides during certain growth periods or during night time when actually nobody should be working in a factory, for instance, and exactly during those times the major discharge of effluents take place. So, that is when those spot checks should be run to monitor or detect what is going on outside the ((Refer Time: 17:57)).

So, this means, that on water quality we still have to differentiate between a continuous measurement and a point measurement. Even at these primary stations there will be not, usually not continuous measurement, sometimes this exists. And there should be a priority to some key parameters, which are indicative to a certain region. If there is a certain industry in place, this monitor may be for certain parameters that you expect associated with that industry to monitor what is going on in terms of water quality. So, it does not make sense to monitor everything possible or anything that local laboratory is capable of monitoring, but to put the resources specifically into monitoring what is relevant to specific river basin or river system.

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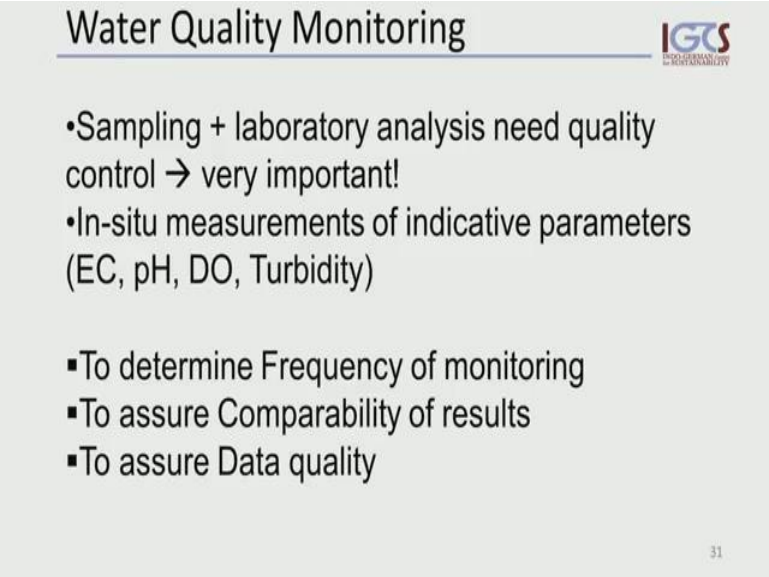

Important on water quality monitoring is also the sampling procedure as such, which is determined by the type of parameter we are analyzing, the level up to which we want to analyze the information. We want to get it as the qualitative or quantitative measurement.

It is determined by the laboratories needs and then, there must be a quality control component to the laboratory analysis themselves.

So, it should be a registered or authorized laboratory that conducts these water quality monitoring analysis so that they become legal documents. Laboratory report about the water quality monitoring should have the level of a legally accepted document. So, this is extremely important and very often forgotten because already, at the sampling, in the sampling procedure phase by just picking one river and empty wine bottle, put water sample into that or something else and then the transport fails from the sampling site to the laboratory and so on. There are so many things that can take, can go wrong already in the sample point, which make the entire quality monitoring a nonsense operation.

Now, and then there are parameters, which have to be measured in-situ. There is no need or meaning in measuring EC or pH somewhere in a laboratory later and it is being measured in laboratories. It is part of the sampling preparation to feed this in a certain analytic equipment for measurement, but to know about the water quality in-situ of that specific river or that specific groundwater, those parameters have to be measured immediately during as part of the sampling. And these parameters are indicative parameters, which give us an idea about the water quality ((Refer Time: 21:31)) issue, that would require further attention. So, if additional sampling, additional laboratory analysis are actually required, that is something in parts already, estimate from our in-situ parameters.

Now, important to water quality monitoring also is the frequency of monitoring, should be only monitored thrice a year, just before the rainy season or just a peak dry season, should we monitor every month or every second week? What should be the frequency of this? And this depends on our budget and it depends on the objectives of the monitoring. And we should be able to assure comparability of the results and this has to do first of all with the sampling in itself, but it also has to do with the laboratory, how ((Refer Time: 22:36)) quality control standards are in that specific laboratory. And we have to assure data quality, which comes down to how we record our data in databases or in data and information management systems so that this information is not being lost or transformed into a useless information just because not all digits can be maintained in the database or some errors between transforming the same information from one unit into another unit and so on.

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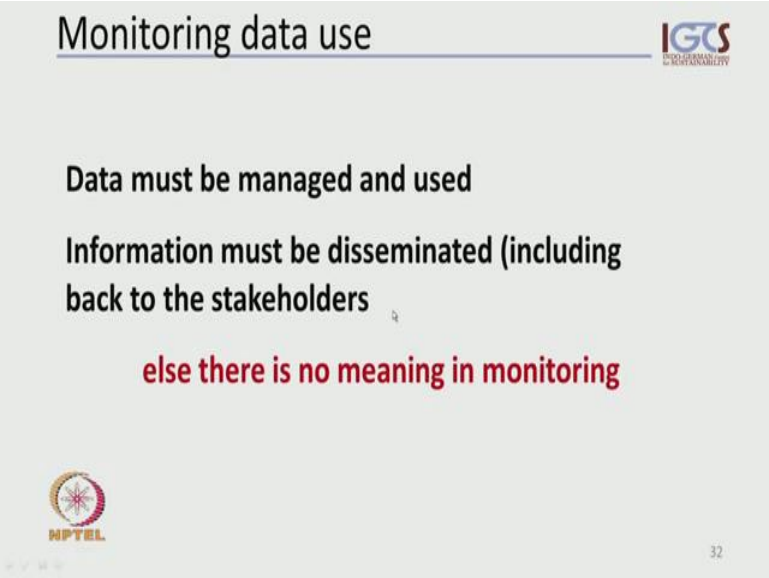

Now, the monitoring data use makes only sense to monitor data and manage the monitoring stations if this data that we collect from these monitoring systems are actually used and managed properly. So, that also means, that it is not only capturing that data putting it to into a system somewhere, it must be transformed into information and it also must reach back to the stakeholders.

There must be a mechanism to disseminate that information. Remember, that what we measure in this very moment is being outdated the moment we get our results from the laboratory. So, it is past information and as time moves on, that information becomes even less useful in many cases in terms of water quality. So, it is important to only monitor if that information flows comes into use into practical decision taking.

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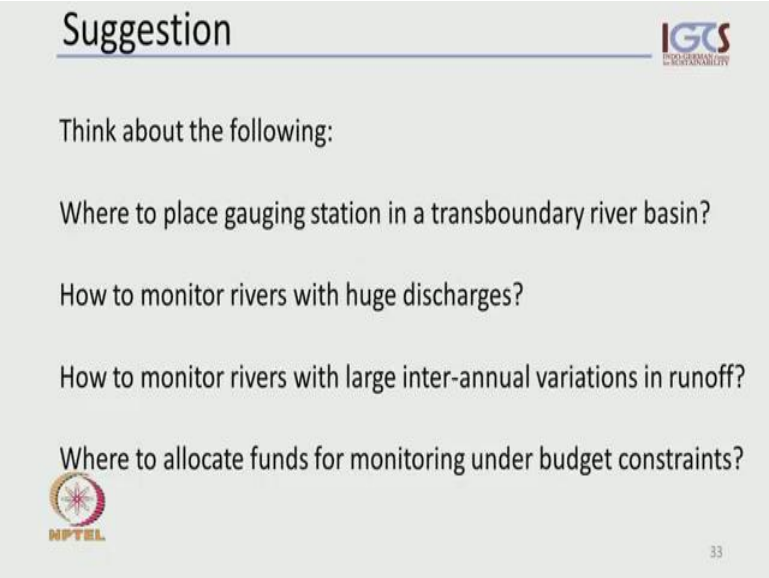

Now, suggestion to take home for you and think about. Where would you place gauging stations in a transboundary river basins? Think about this. How would you monitor rivers, which have a very huge discharge? How would you monitor rivers with large inter annual variations?

Let us say, the river falls dry during some months of the year and then, it may have a very large discharge again or there may be a situation where the river may have reverse flow depending in a flood plain scenario, for instance, and the next months it will have again the ordinary direction of flow, what, how would you monitor such rivers and where would you allocate your funds from monitoring under budget constraints?

With this these questions or suggestions I would leave you now and I will see you next time again.