MICHIGAN DEPARTMENT OF NATURAL RESOURCES

WATER

Suggested Projects for Classroom, Laboratory or Field Trip

April, 1956
Reprinted June, 1970

WATER RESOURCES

Water is our basic resource. The following suggested activities are not arranged in what we think is the order of importance nor are they arranged according to grade levels. It is suggested that teachers make their own grade level selections and also that suggestions in this outline be correlated with suggestions in the other outlines issued by the Division. You will find that the various activities overlap because all phases of conservation overlap.

ATTITUDES

1. Water should not be considered as an enemy – it is our best and most important friend and is necessary to us in a great many different ways.
2. The quantities required are enormous.
3. The quality must meet certain standards.
4. The available supply in Michigan is not lessening except by pollution, rupture of artesian caps.
5. But demands are steadily growing – faster in some places.
6. Water conservation is a public problem. Requires community interest-action. Citizenship.
7. Water conservation is wise use – the specific activities in any place must be determined on the basis of what uses are there made or desired.
8. Water conservation is inescapably tied in with land use practices.
9. Search for water is work of the student of water and earth history – the hydrogeologist. Getting water to the consumer is an engineering problem.

I.

1. From where does water come? Discuss clouds, rain, snow, wind. Discuss movement of water from ocean, lake, river or any body of water into the air.
2. Where does water go when it reaches the earth? Does it go into an underground lake or river? Discuss porous rock, subsoil and soil. Only in limestone regions do we have underground lakes and rivers. Define ground water reservoir.
3. Make drawing showing the hydrologic cycle. How does water get out of the ground? How does man get it from the ground? Do plants take water from the ground? Cover a small plant with a dry tumbler. Explain what happens in a day or perhaps a few hours. Where does the water go that evaporates? With 1, 2, 3, as basis, discuss the hydrologic cycle.
4. Obtain several 8-ounce clear glass tumblers. Fit a fine mesh screen half way fro the top of the tumbler. Place 2 inches of sand on the screen in one tumbler, 2 inches of fine gravel in another, and 2 inches of clay in another. Fill the tumblers with water. Discuss what happens. (A piece of fine crash cloth pushed into the tumbler like a sack and held in place by a rubber band will serve if screening cannot be obtained.) Discuss screens in wells. Discuss capillary movement of water – may be a part of a physiology or osmosis experiment also.
5. Get pieces of sandstone, marble, slate, shale, granite. Submerge each in water to 1/3 its largest dimension. Discuss the activity of water in relation to each rock. Discuss sand in relation to ground water.

II. THINGS TO DO.

A. 1. Make a rain gage and collect rainfall records for a month or more. At end of month call on nearby U. S. Weather Bureau observer and see how your record compares with his. Obtain record of past years from U. S. Weather Bureau, East Lansing, and note variation from place to place, year to year, month to month.

2. Set up illustrative computations – how much water in ¼" of rain on one acre. What flow in a stream draining ten square miles to carry away water from a 2" rain in 24 hours, allowing 20 per cent runoff, 40 per cent, 80 per cent? How much rain and snow falls on a city lot 50' x 150' in a year's time at 25", 30", 35"? How much on a township? How long would one have to sprinkle a lawn 50' x 40' to equal the water in ½" rain, if the hose flows 2 gallons per minute? 4 gallons per minute? (Civics, History, Math.)

3. An upright tin can can serve as a rain gage. It is preferable that the can be fairly large, say 6" to 10" in diameter. Such cans may be obtained at any gas station. For accurate results, the top edge should be reasonably sharp and smooth. Since it is difficult to measure light rainfall directly, a funnel arrangement in the bottom of the large can, directing the water into a can of substantially smaller diameter, is helpful. Thus, if the large can

is 8” in diameter and the small can 2” an accumulation of 4” in the small can would represent ¼” rainfall. (Ratio of radius squared.) A few drops of light oil may be put in the small can to prevent evaporation. The gage can be secured in a light wooden frame and fastened to a low post or platform at a distance from trees or buildings equal to the height of the trees or buildings. The frame should not reach the top of the large can. Why?

B. A very effective snow sampler consists merely of a length of 4” stove pipe which may be pushed down through the snow and when lifted will bring up a cylinder of snow. Take a yardstick and measure snow depth at many places. Collect several samples at sites of average depth. Put in a pail together, melt, measure volume, divide by number of samples used and number of square inches in stove pipe opening. Result is inches or water represented by snow on the ground. This can be tried several times during the winter with interesting results.

C. Older, mechanically minded boys say like to build an evaporation pan using a tub, copper tubing, small float valve and a standpipe reservoir made of 3” pipe. A glass tube and graduated gage will show water level in the standpipe and frequent reading will show the evaporation rate as it changes during the day. The pan should be fenced from animals.

D. Raise potted farm plants – potatoes, corn, tomatoes, wheat, beans, etc. Keep accurate record of water used. From results, compute water requirements per acre in inches, in gallons. Note: Results will become most significant after plants have reached an appreciable size. After experiment is finished, cut and dry the plants. Compute water use per pound of dry material. This study could be combined with experiments on soils and fertilizers.

E. Make a glass-sided terrarium with landscape. Build a sloping base of fine gravel or coarse sand, covering all but upper portions with soil. Shape soil into sloping fields. Simulate contour farming, sod waterways, forestation of steep slopes, terraces, gullies. Leave outlet hole in terrarium at low end of “1 [?].” Introduce water in exposed gravel at upper end. Simulate rivers, artesian wells, springs, by regulating flows. (Won’t guarantee results from this project – likely too difficult, although some students might make it a real show.)

F. Keep a record of the different kinds of domestic water uses for one clay, the quantities used in each and total consumption. (Use also in arithmetic.)

G. 1. Study the school water supply. If it is a well, learn capacity of the pump, let pupils alternate in clocking its operation time for one day. Compute monthly, yearly, per capita use.

2. If from a municipal system, obtain water bills from superintendent’s office and compute per capita use.

3. Measure loss from leaky faucets. Compute annual loss. Estimate loss from leaky toilets.

H. Study water borne diseases.

I. Collect small stream bottom life (insect larvae, crustaceans, shellfish, minnows, etc.) and maintain a native aquarium. If done in late spring, hatching of dragon flies, mayflies, storeflies might be observed. (Note: if collection is made above and below a waste discharge into the stream, there may be a marked difference in the numbers of insects and stream life forms in the sample.)

J. Prepare water conservation posters. Collect scenic photos of water resources.

K. Plan an ideal lakeside or streamside park (or build a model) – ideal water and land conditions. Plan an ideal tourist cabin area making best use of local water resources. Consider everything you would wan if you were the tourist.

L. Determine from local inquiry and observations the local water problems.

M. Check the items in a daily newspaper, farm magazine, contractors’ magazine, news weekly, to see how many items deal with water. Prepare an exhibit of such items. See how many different water uses or water problems they deal with.

N. 1. Hold a class discussion on pleasant things associated with water (e.g., a cool drink, camping, skating, snowballing, rainbows, coffee perking, fishing, rain, waterfalls, a warm bath, air conditioning, ice cream sodas, sea stories, playing with water in the sand box, clean clothes, watermelon, speed boat rides, steam heat, electricity, frost).

2. Consider ways in which enjoyment of the listed uses could be interfered with. Note: Pupils will readily identify ways in which the resource itself might be injured. However, note also such less obvious but important things as public access, price, local availability, leisure time to enjoy, preservation and improvement of environment, frame of mind to appreciate, educational background to understand and use wisely. Might lead to or fit in with consideration of citizenship, American way of life, anti-vandalism, anti-communism.

O. Weigh an apple, a potato, a cluster of lettuce leaves, lake to dryness and reweigh. Compute water percentages.

P. Observe lime or iron deposits in teakettle» cooking utensils, fountains, sinks, etc., in steam pipes and water pipes, on well screens.

Q. Shake up bottles of water containing sand, clay, marl, silt, mixed soils. Observe time it takes to settle out. Compute distance material could have traveled in that time in a stream at ordinary flow rates – 2 or 3 feet per second.

R. Figure how much water is required to produce an egg, slice of bacon, glass of milk, based on water consumption of the food plants, weight of food consumed, number of acres required to grow food, rainfall per acre, etc.

S. Study poetry, literature dealing with water. Have students give five-minute talks on phases of water which interest them, prepare essays, stories, descriptions.

T. Discuss historic events which have been influenced by water (navigation, drought, isolation, power, mining, irrigation, etc.).

III. THINGS TO OBSERVE

A. Erosion

1. Gullies. Note and map location. Observe how gullies grow in the direction of their upper end. See how they develop tributaries. Note how soil is mixed with subsoil in erosion. Point out that gullies not only become areas of no use, but become obstacles and hazards in cultivation, machinery movement, roadways and livestock paths. Estimate how gully started – how it could have been prevented. Follow mouth of gully to learn where eroded material was deposited. Did it cover soil, fill drains, clog streams? Does it have much richness of its own?

2. Plan means for stopping gully extensions – for filling it or smoothing it down. Keep watch for new very small gullies just starting along road banks – in fields – pastures. Study stream valley and imagine how it formed. Point out that streams are natural drains. Study how gullying has ruined lands in other states – other countries. Compute area of gully and delta. Convert to acres – to bushels of potatoes, etc., that could be growing on that area had the gully not formed.

3. Sheet erosion. Note tiny water channels in sloping cultivated field after heavy rains. Where did the eroded soil go? Measure depth of channels and estimate loss per acre. Compare with nearby pasture land or hay field – or woods. Study how to avoid sheet erosion.

4. Stream bank erosion. Note steep banks. Observe how easily soil is dislodged where bare, how stable where grass and brush covered. Observe effects of cattle climbing up and down banks. Note exposed roots of trees, they didn't grow in the air. Look for deposits of silt, clay and sand downstream from erosion sits. Explain how silt filling forces stream out of its channel, throws it against banks during flood.

5. Note how barren of life sand or silt bottom is, how rich in insect life (fish food) gravel bottom is. Learn about stream improvement methods, piling rock layer against eroding banks, installing deflector logs and walls, other measures. See how a stream can be attractive and useful if treated right, ugly and useless if mistreated.

6. Raindrop erosion. Note how eaves drip splashes sand and soil far up against side of building, how each falling drop produced a miniature explosion which tears the surface of the base soil to pieces.

7. Beach erosion. Observe destruction along Great Lakes beaches. Investigate attempts to control erosion. Find out cost. Plan use of beach area which would permit erosion, and beach building with a minimum of damage. Do lakes always damage their shores?

IV. PLACES TO VISIT

A. Municipal water treatment plant

1. Find out where water comes from, how it is treated (chlorinated, softened, iron removed, etc.), how it is distributed.

2. Learn what it costs, how many people are employed in providing your water supply, what they do, how much water is supplied by the plant, how the demand varies during the day and the year, how the demand is growing, whether new sources are planned, whether present source is adequate. (Use also in arithmetic classes.) Map location of water mains. Inquire about the estimated maximum demand for fighting fire.

3. Find out what problems confront your water supply department, what breakdowns occur, how long the supply can be cut off for repairs, what effect prolonged shutdown has on industry, domestic supply. (Social studies.) Inquire who are big water users, what they use water for.

4. See if your water situation is an asset to attract industry and other revenue-producing enterprise - whether citizens give the necessary support to water department in development of best possible supply.

5. Ask how deep are wells (if any), how cold is the water, how are water levels behaving. Ask to see well drilling samples. (See Geology Activities.) Inquire whether State Health Department endorses the system, whether assistance of State Geological Surrey has been obtained in appraisal of local ground water resources.

6. Find out financial situation of water department. Learn what are big cost items in operation, maintenance, repair. Determine whether water is available to every house in city. Are all connections metered, or is there a flat charge?

7. Ask to see State Health Department reports on water samples. Have them explained. Are the reports ever unsatisfactory? What is the quality of the water (if not treated) - how hard! How much iron? How much money in soap would softening save the housewives?

8. When were water systems improvement proposals last before the city government? Who proposed them? If not the water department, what did it propose? Who voted against the improvement? Why? (Social Studies Civics.)

9. Is Fluoride addad to supply to prevent tooth decay? If so, for how long? If not, has it been proposed? Why turned down?

10. Are there any sources of ground water pollution near the municipal wells? Any industrial waste disposal pits? What is the waste? Does the State Health Department know about them? County Health Department? If the water comes from a lake or stream, how clear is it? Any pollution from upstream? If so, what is being done about it? What type of filter is used? How backwashed?

11. Is the water department self-supporting? Are its revenues used to assist in the financing of other city departments? How are water main extensions financed? Have the water rates been increased within the last twenty-four months? Did the residential user bear the brunt of this rate increase? Or did large consumers, the commercial and industrial users, share?

B. Municipal Sewage Disposal Plant

1. Is the sewer system a separate or combined collector? If a combined system, how is storm runoff handled? Are diversion chambers used? Are they automatic in operation? What lake or stream receives this storm flow?

2. What type of treatment is employed at the treatment plant? Are present facilities adequate to handle the average daily flow of sewage? Has the sanitation department considered future needs of the city for treatment? Has consideration been given or are plans being prepared for additions or a greater degree of treatment?

3. Has your city always taken a progressive attitude in regard to providing adequate sewage treatment facilities or has the State of Michigan had to force the issue to provide proper treatment?

4. How were the present facilities financed? Does your sanitation department operate on the more modern self-supporting utility plan or are operating and maintenance expenses paid from the taxes collected each year?

5. Other than residential sewage, who are the major contributors of sewage to the system? Do any industries contribute wastes which are difficult to treat or place a heavy load on the plant? How affective is the treatment plant?

6. What percentage of Bio-chemical oxygen demand and total solids is removed? If either is below 90 per cent, ask why.

7. Does the plant effluent (treated sewage) discharge to a lake or stream? Does this cause any damage to the receiving waters? Is this final effluent chlorinated to protect downstream users or possibly bathing facilities nearby? Do any municipalities down river use the receiving stream for a public water supply?

8. Is the Michigan Department of Public Health satisfied with this plant's operations? If not, what do they believe needs improvement? Is the entire city served with sewers or are parts without service? Are sewer extensions paid for entirely by assessments or are a portion of costs paid for by the city at large?

C. Fire Department

1. Ask for information about water using equipment. How many hose? What is the capacity of one hose? How much water per minute for a big fire? Does the pressure hold up? How much storage does the municipal fire system have? How fast can it supply water after the storage is gone?

2. How many fire hydrants in city? How close together? What size mains do they connect with? How are they protected in winter?

3. If two fires break out at the same time, is there enough water to handle both? To handle auxiliary trucks brought in from other towns? Does the fire department go out of the city to fight suburban or rural fires? Do they find enough water to fight fires at those places.

4. How should homes outside the city prepare for fire fighting? How important is it to get water started on a fire immediately? Can a few extra outlets equipped with garden hoses help much? Where should the water be sprayed? Are most rural and suburban systems as big as they should be for fire fighting?

5. Where is the hydrant closest to your school? How quickly could the fire department come after an alarm? (Math, Geography, History, English.)

D. Farm

1. What is the source of supply? If wells, how many? How deep? What capacity? Explain pumps. Electric or gasoline? If electric, is there an auxiliary source for emergency?
2. How much water storage in system? How long could farm get along without water? How much water does it take for a cow per day? Is water piped to barn? Does adequate, inside supply improve milk production?
3. What is pasture source? If stream, does it ever fail? Is it polluted? Have cattle ever died from drinking it? Is anyone using it for irrigation yet?
4. Has farmer ever had occasion to inquire into his water rights? Is water source adequate for present use? Are plans being considered to increase supply?
5. Does draught cause such loss? About how frequently is drought a problem? If irrigation is being practiced, what is source? How long has system been in operation? Has it paid? Is continued or additional irrigation proposed? How much water does system take? What rate of pumping? How many acres being irrigated? What crops? Is source dependable? Are others likely to require that source be shared?
6. How about fire fighting? Are outlets readily available? Hoses? Is system adequate? Pressure? How long would it take fire department to reach farm after alarm? What could be done to control fire while waiting for fire department? Are farm buildings and contents insured for full value?
7. How long since well was repaired? If a sand or gravel well, what size opening in the screen? Were opening size and screen length determined on basis of sieve analysis of samples? Was well surged to improve its capacity after completion?
8. How hard is water? How much iron? How much salt? How is “log” made? (A “log” is a record. In geology, it is a record of the soil, subsoil and rock a well penetrates.) Who uses it? Is “log” of this well known? On file with the State Geological Survey? What advantage is gained by knowing the well log?
9. Has domestic supply been tested for bacteriological purity? How recently? Any nitrates or nitrites reported? (A cause of one type of blue babies.) (Chemistry, Physiology.)
10. How is gasoline, kerosene, fuel oil stored? Any history of leaks? Any other possibility of bad tasting or poisonous materials entering ground? How near to well? How long have these been there?
11. How close is sewage disposal system to well? Upslope or downslope from well? Any nearby industries dumping waste onto ground? How long? Which way do wastes move after entering ground?
12. Any food problems? Drainage? How close together are tile drains? How deep? Do they work satisfactorily? Is further drainage necessary? Planned? Are outlet drains adequately maintained? How was design of tile fields and outlet drains made?
13. Does farmer practice soil conservation? What is involved - contour farming? Grassland farming? Sod waterways? Terracing? Any gullies on farm? Any siltation of drains? Streams?
14. Is there a farm pond? Any planned? If there is one, what use does it serve? Stock water? Fishing? Spray water? Scenic beauty and property value enhancement?
15. Any reforestation of light soils? Steep slopes? Are cattle fenced away from river to prevent bank erosion except at selected watering sites? Have banks been planted to shade water? Attract wildlife?
16. Do farm boys trap muskrat or mink? Hunt ducks? fish? Swim? Are farms or nearby facilities for these activities improved? Any plans for improvement?
17. Is public permitted to use farm waters for hunting, fishing, swimming, etc.? If so, do they respect farmer’s property and rights? If not, would farmer admit public if he were sure it would respect his interests? Has local municipality ever approached him on making his water facilities available? Has local sportsman’s club?
18. Does farmer feel that water rights legislation is needed to protect his future welfare? Does he think state should take an active part in water conservation?

E. Industry

1. List Industries in your town. For each industry, apply the following:
2. What is water source? Is it adequate? If own wells, how deep? What diameter? What capacity? Are “logs” known? On file with State Geological Survey? Any trouble with wells? Any improvements planned? Is quality satisfactory? Have test wells been drilled?
3. If lake or river intake, is source dependable? Pure? Do water levels cause trouble (flood or drought)? If municipal, is source adequate? Can supply be increased?
4. How is water used in industry? How much does it cost? Would more water be of value? Better quality? Lower temperature? How does industry add to the welfare of the community? If supply failed what effect would it have on industry?
5. If industry had to move, would water supply be important in the selection of its new location?

6. Does industry have a waste disposal problem? Has the industry solved its own problem? How? Has It been called before Water Resources Commission? Put under order to control pollution? How such is waste treatment costing? Explain problem and methods of control. Has the industry profited financially by its method of waste disposal?
7. What harm would, or do wastes do - kill fish? Harm livestock? Impart taste or odor? Cause deposits in stream bottom? Harm waterfowl? Contaminate ground water?
8. If dumped on the ground or in pits, what happens to waste? Can it mix with ground waters? Which way does it move? How is this known? Verified by state?
9. What is trend in water use? Estimated needs 5 years from now? 25 years from now?

F. Parks and Picnic Grounds

1. Visit local water-side recreation areas. Analyse them carefully. How do they differ from the best of which students know? Are they as good as possible? Could they be improved? How?
2. Could wading-swimming be better than it is? Is the water dirty? Where does the dirt come from?
3. Is the area readily accessible? Safe? Attractive?
4. Has the community ever carefully studied how it could be put into greatest usefulness? Does your community have all the water-side recreation facilities it needs? Is water-side recreation important to your community for enjoyment of residents? For attraction of tax producing, job making industries?
5. List the advantages to your community, to your school, and to you personally of public improvement of local water-sides such as brooks, rivers, ponds, lakes.

V. PLACES TO WRITE FOR INFORMATION

U. S. Weather Bureau 303 Abbott Road East Lansing, Michigan 48823	Rain and snow records
U. S. Geological Survey 700 Capitol Savings & Loan Building Lansing, Michigan 48933	Stream flow data
Michigan Water Resources Commission Stevens T. Mason Building Lansing, Michigan 48926	Information on water quality standards, pollution, stream studies
Geological Survey Division Stevens T. Mason Building Lansing, Michigan 48926	Information on local ground water conditions
U. S. Lake Survey 630 Federal Building Detroit, Michigan 48226	Great Lakes levels chart
Michigan Department of Public Health 3500 N. Logan Lansing, Michigan 48906	Bulletins on well construction, wastewater programs, etc. Films about water
State Soil Conservation Committee 324 Natural Resources Building Michigan State University East Lansing, Michigan 48823	Sod waterways, farm ponds, general soil conservation
County Health Department directors	Talks or information on local water supply, sewage disposal problems
Film Loan Service, Department of Natural Resources, Stevens T. Mason Building, Lansing, Mich. 48926	Film – “Your Life….Water”