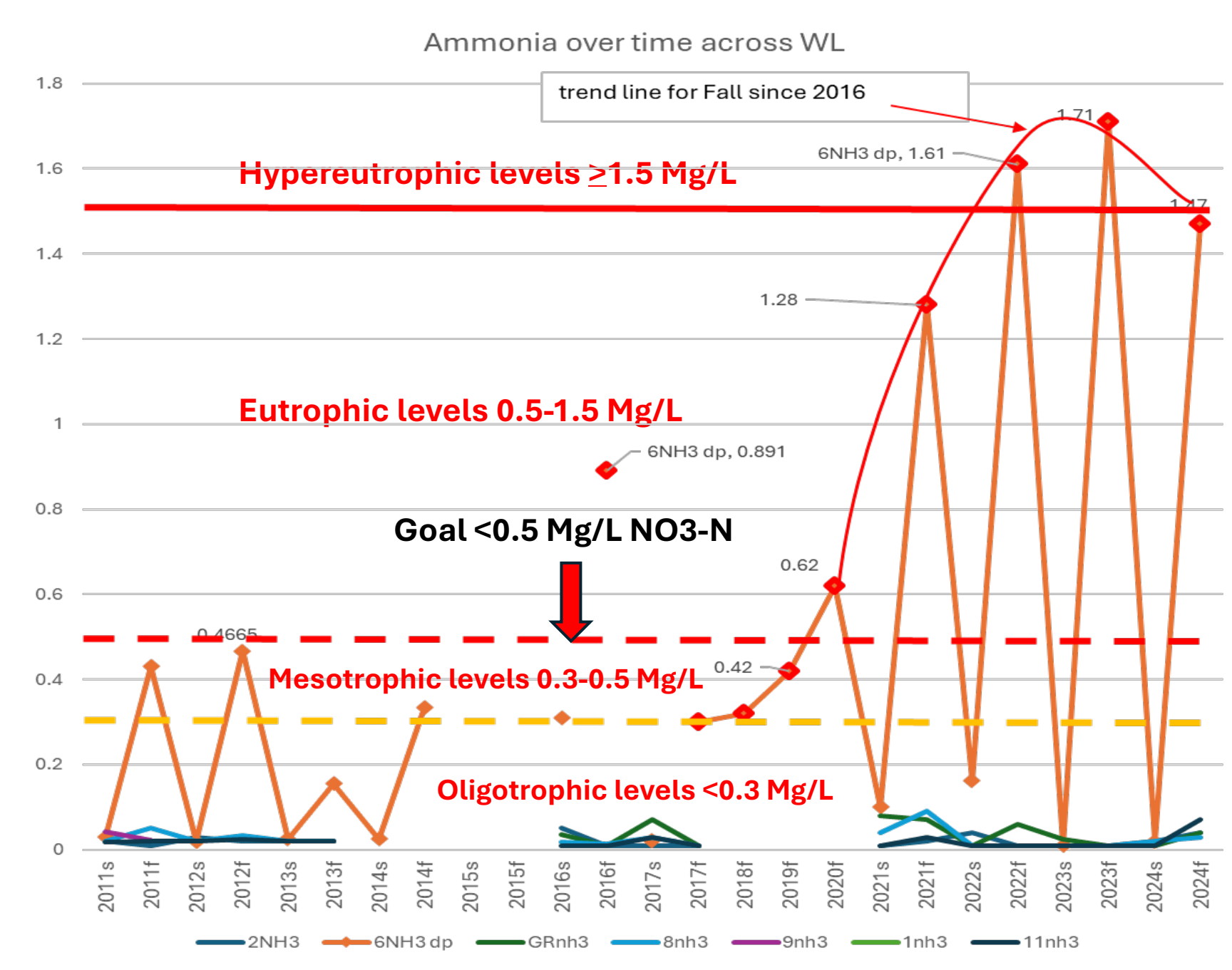
<u>Organization of Woodland Lake (OWL)</u>

Discussion of concerns and research understandings relative to the Proposed PUD Development

RZ #25/01 FOR THE COVE AT WOODLAND LAKE



s = spring levels, f = fall levels

-No O2 for aquatic life
-Hypereutrophic lakes are extremely difficult to restore

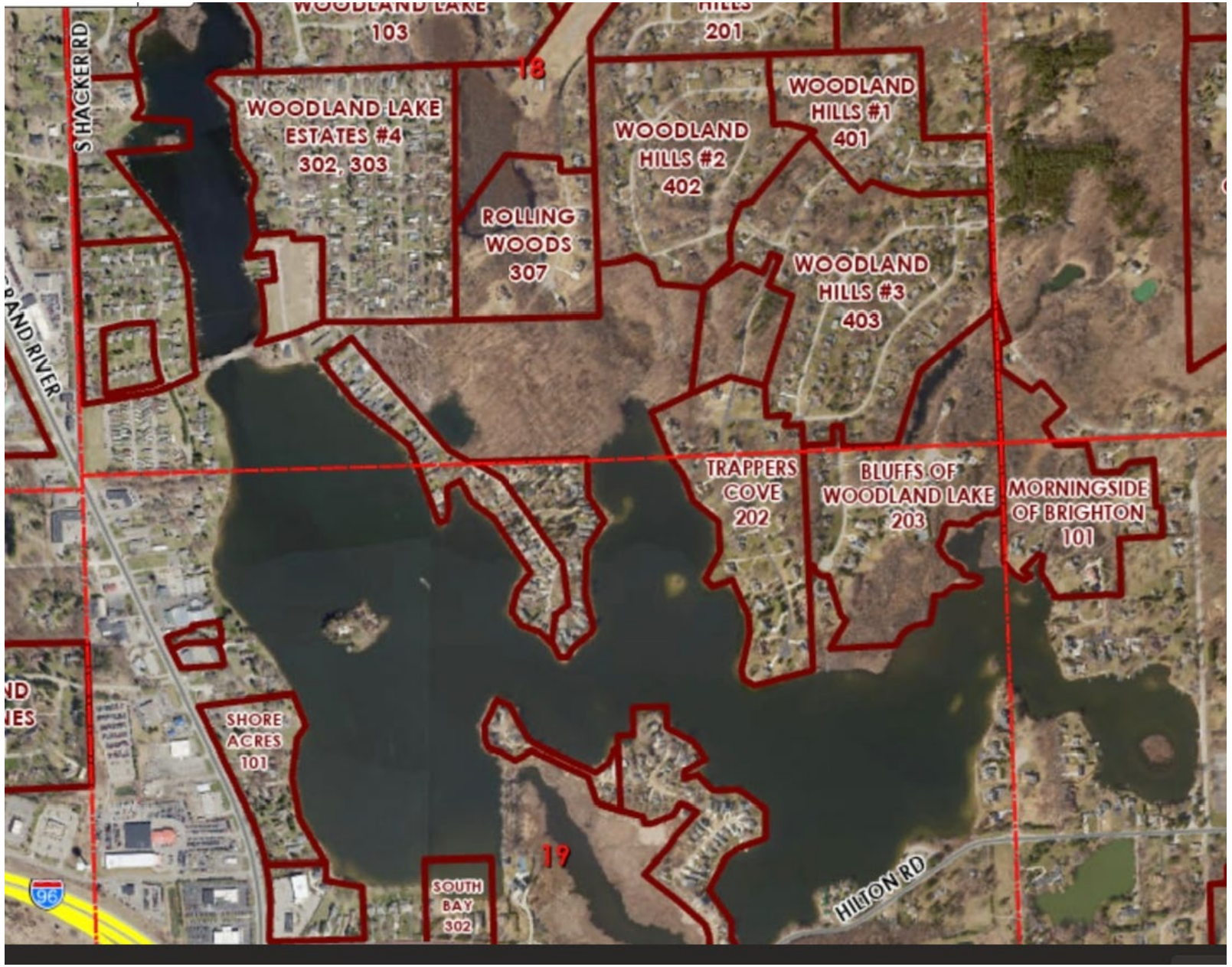
-weed growth and frequent algae
-oxygen low in the shallow spots.

Station 6 is our Master station

Woodland Lake nutrient and contaminants exceed the lake's natural filtration capacity since 2012.

This timing coincides with the increasing contamination seen from the drains

A good approach, combined with modifications, could drive responsible development for proposed area



Planning Committee did a nice job of protecting the **Woodland Bluffs** Wetlands 25 years ago.

Built between **25 to 35** feet above lake level, with vegetative buffer zone and wetlands to filter runoff. Good concept, plus we **know more now** about impervious surfaces and **stormwater management**

This is the only remaining large area of wetlands and vegetation left around our lake to take up nutrients is where the new PUD development is planned

Based on environmental studies and zoning regulations, the highest impervious surface percentage that can generally be effectively mitigated for nutrient runoff (specifically phosphorus) to an inland lake ranges from **25% to 30%**. While impervious cover above 10% begins to degrade water quality,, rigorous, modern stormwater management practices (Best Management Practices, or BMPs) can maintain lake health up to this 25-30% threshold.

Key Thresholds and Mitigation Levels

- **<10% Impervious:** Optimal for maintaining pristine water quality.
- **10-25% Impervious:** "Impacted" range. Mitigation is required to prevent significant nutrient loading.
- **25-30%+ Impervious:** "Degraded" range. Effective mitigation becomes extremely difficult, often requiring extensive engineered, site-specific solutions to avoid severe degradation.
- **Regulatory Limits:** In many sensitive shoreline areas, 15% is the limit for automatic approval, while 30% is allowed only with an approved, comprehensive mitigation plan.

Effective Mitigation Strategies

To manage nutrient runoff at these higher impervious levels, a combination of techniques is necessary rather than a single solution:

- **Infiltration & Filtration:** Using rain gardens, bioswales, and infiltration basins to trap phosphorus-rich runoff.
- **Vegetated Buffers:** Maintaining native vegetation along shorelines to filter water before it enters the lake.
- **Permeable Pavement:** Installing permeable pavers in driveways and parking lots to reduce direct runoff.
- **Wet Detention Ponds:** Utilizing ponds with littoral zones to promote nutrient uptake.

Factors Limiting Mitigation

Even with high-end mitigation, areas exceeding 25-30% impervious cover often suffer from irreversible degradation due to:

- **Overwhelming Volume:** The sheer volume of water in high-density areas often bypasses systems during large storm events.
- **Soluble Phosphorus:** While suspended solids are easily filtered, dissolved phosphorus is hard to remove, making high-density residential or commercial areas difficult to manage without advanced, costly treatments.

With Best Management Practices, such as effectively infiltrating forebays and sedimentation basins and vegetative buffers, the highest impervious surface percentage that can be effectively mitigated for nutrient runoff to an inland lake ranges from 25 to 30%

Even with high end mitigation, area exceeding 25-30% impervious cover often suffer from irreversible degradation due to:

- **Overwhelming volume of water bypasses systems during large storms**
- **Soluble phosphorous: Suspended solids are easily filtered. Dissolved nutrients are difficult to remove.**

A.I summary of over 200 U.S. Studies, including EGLE, USGS. Michigan Lake and Streams

Sec. 16-04 Private Roads

a. The maximum length of a private road served by a single point of access shall be seven hundred fifty (750) feet with a maximum twenty four (24) lots served by a single means of access

16-04 b

6 a. The Planning Commission may allow cul-de-sacs longer than seven hundred fifty feet if all of the following apply:

3.) The road does not access more than twenty-four (24) lots.

31 lots enabled. R2 has 3,440 feet, over 4.5 times the ordinance allowance

The following ordinance is negatively impacted by the violation of the above ordinance

Sec. 10-06 Development Standards and Guidelines (Nat Features Overlay)

(h) Stormwater Drainage/Erosion Control.

a. Limitation of land disturbance and grading.

Maximized impervious and grading

b. Maintenance of vegetated buffers and natural vegetation.

Minimal room for Vegetative Buffers

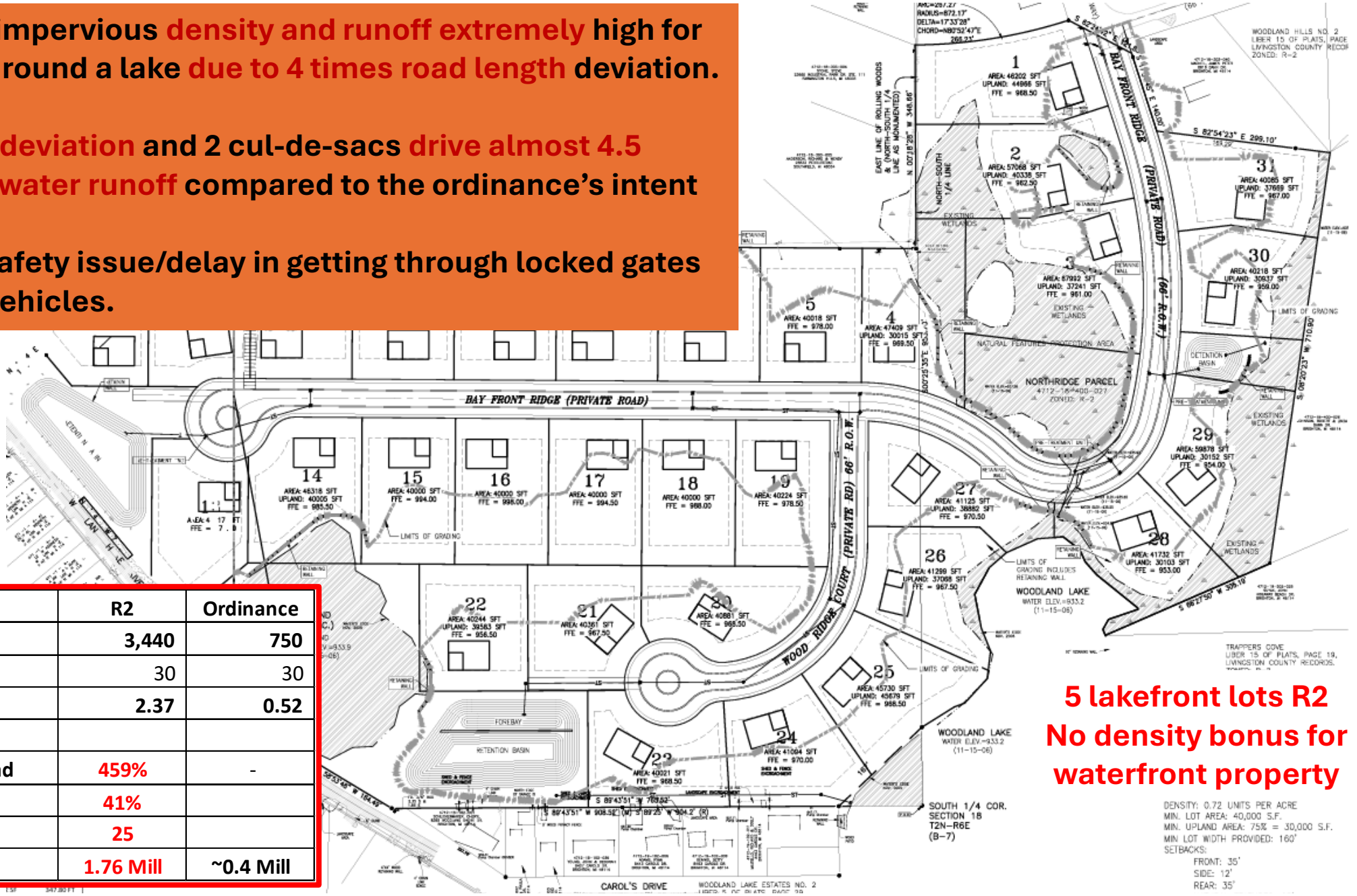
c. Minimization of impervious surfaces.

41% impervious, 25 acre drain field.

Concern: Total impervious density and runoff extremely high for developments around a lake due to 4 times road length deviation.

The road length deviation and 2 cul-de-sacs drive almost 4.5 times the stormwater runoff compared to the ordinance's intent

Also creates a safety issue/delay in getting through locked gates for emergency vehicles.



	R2	Ordinance
Length of roadway	3,440	750
width of roadway	30	30
acres of roadway	2.37	0.52
Percentage increase in road	459%	-
Total Impervious surface	41%	
Total Acres	25	
Runoff/day 100 year rain	1.76 Mill	~0.4 Mill

5 lakefront lots R2
No density bonus for waterfront property

Does not include the additional runoff due to the 31 homes and driveways versus ordinance limit of 24 (+7 homes/drives)

Sec. 12-01 Intent (PUD)

(c) These PUD regulations are not intended to be used for circumventing the more specific standards in the Zoning Ordinance, or the planning upon which the standards are based. …. If this improved quality is not clearly apparent upon Township review, a site shall not qualify for the modifications allowable under this Article
(10) **Encourage development that is consistent with the goals stated within the Township's Master Plan.**

Sec. 12-03 Types of PUDs

The Township's Master Plan is the basis for which type of PUD is appropriate in specific areas in the Township.

Sec. 12-08 PUD Design Standards

Regulatory Flexibility. The setback requirements of the pre-PUD zoning district shall be used as guidelines for the PUD. To encourage flexibility and creativity consistent with the intent of the PUD regulations, the Township ***may*** permit specific departures from the requirements of the Zoning Ordinance. **A table shall be provided on the site plan that lists all deviations and regulatory modifications. Deviations shall *only be approved*** through a finding by the Planning Commission that the ***deviation will result in a higher quality of development*** than would be possible using conventional zoning standards. **Only those deviations consistent with the intent of this Article shall be considered.**

Sec. 3-03 District Regulations

(11) Waterfront Residential Minimum Lot Size. No density bonus will be granted for any waterfront property regardless of the zoning.

(Ord. #243, 8/1/08), (Ord. #231, 12/27/05)

TABLE OF DEVIATIONS – R–2 TO PUD

CURRENT ZONING: R–2
PROPOSED ZONING: PUD

MINIMUM LOT SIZE R–2 ZONING:	40,000 S.F.
MINIMUM LOT SIZE PROPOSED PUD:	16,000 S.F.
DEVIATION:	24,000 S.F.
MINIMUM SETBACKS R–2 ZONING:	FRONT 35 FT
	SIDE 12 FT
	REAR 35 FT
MINIMUM SETBACKS PROPOSED PUD:	FRONT 25 FT
	SIDE 10 FT
	REAR 30 FT
DEVIATION:	FRONT 10 FT
	SIDE 2 FT
	REAR 5 FT
RIGHT–OF–WAY REQUIRED:	66 FT
RIGHT–OF–WAY PROPOSED:	50 FT
DEVIATION:	16 FT
MAXIMUM ROAD LENGTH ALLOWED:	750 FT
MAXIMUM ROAD LENGTH PROPOSED:	2,888 FT (WITH EMERGENCY ACCESS)
DEVIATION:	2,138 FT
MINIMUM ROAD WIDTH ALLOWED:	30' B/C–B/C
MINIMUM ROAD WIDTH PROPOSED:	28' B/C–B/C
DEVIATION:	2 FT
MAXIMUM LOTS ON A PRIVATE ROAD WITH A SINGLE POINT OF ACCESS:	24
NUMBER OF LOTS PROPOSED ON A PRIVATE ROAD WITH A SINGLE POINT OF ACCESS:	40
DEVIATION:	16
MAXIMUM LOT COVERAGE (%) R–2 ZONING:	15%
MAXIMUM LOT COVERAGE (%) PROPOSED:	40%
DEVIATION:	25%

SINCE THE SITE IS ENTIRELY WOODED, NO TREE SURVEY OR NATURAL FEATURES PLAN WILL BE PROVIDED. GRADING AND TREE REMOVAL WILL BE LIMITED TO THOSE AREAS NECESSARY TO BUILD THE ROAD AND INSTALL UTILITIES. NO TREE REPLACEMENT IS PROPOSED.

MINIMUM LAKE SETBACK PER PUD ORDINANCE:	100 FT
MINIMUM LAKE SETBACK PROPOSED (SINGLE FAMILY HOME):	100 FT
MINIMUM LAKE SETBACK PROPOSED (DETACHED CONDO):	50 FT

OVERALL SITE MAP

NO SCALE

Note: The **Baseline plan** proposed has **3,400** feet of road length. **4.5X master plan rqmts.**

-Smaller lots drive higher impervious surfaces
-~4x length of roadway maximum drives excessive impervious surface
-750 foot of roadway =9.375 lots.
-Shorter roads => less acreage for stormwater accumulation
-More people add tire wear, fluids, exhaust and total pollution
-More lots drive higher impervious surfaces and flows

-Many states are pushing 10-15% maximum total impervious surfaces for lots near waterways to address the pollution problem across our country

Many states are moving to larger setbacks to enable buffer zones to help protect inland waterways

These PUD deviations all violate ordinances 12-01, 12-03 and 12-08 and are harmful .

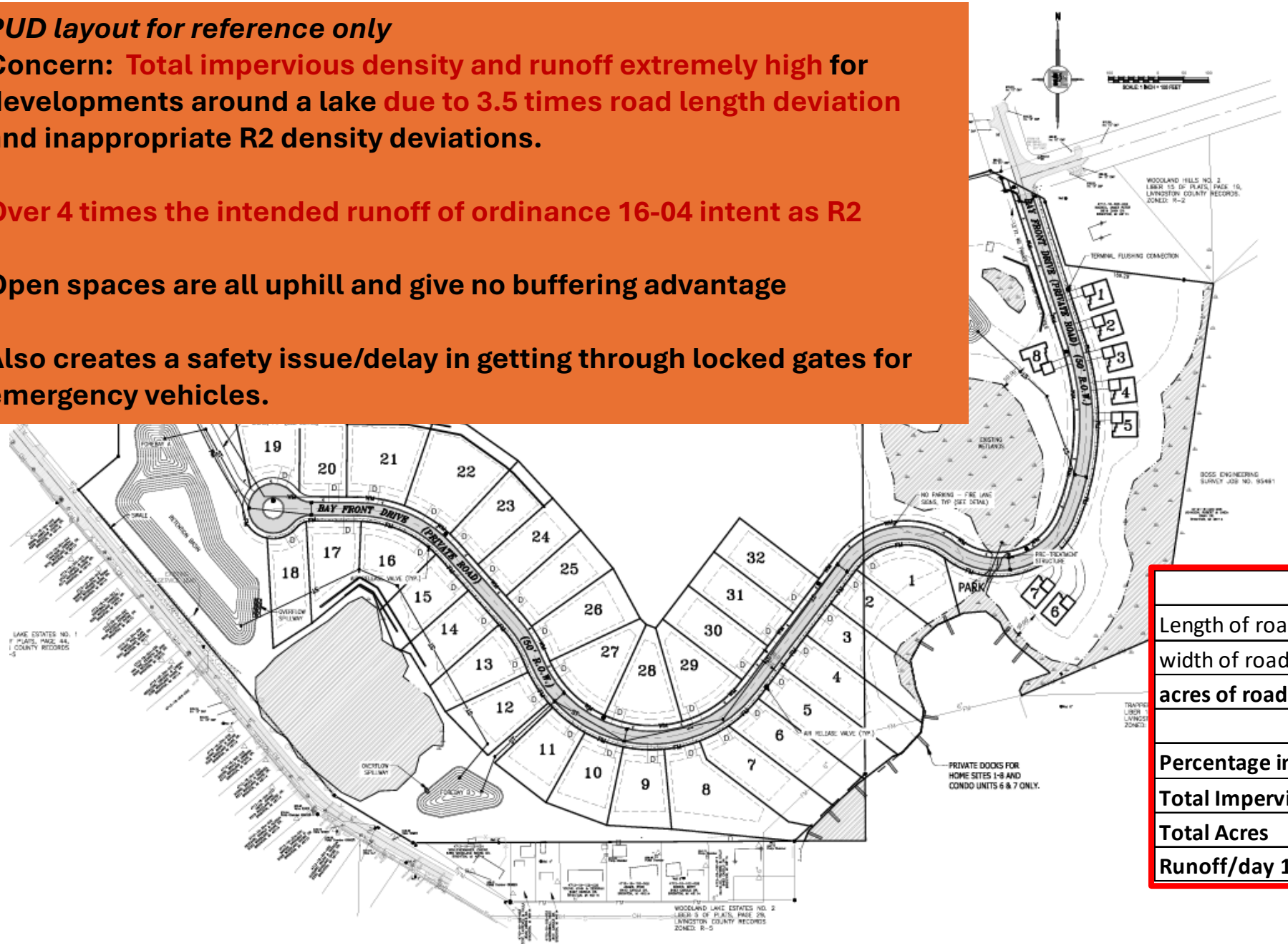
PUD layout for reference only

Concern: Total impervious density and runoff extremely high for developments around a lake due to 3.5 times road length deviation and inappropriate R2 density deviations.

Over 4 times the intended runoff of ordinance 16-04 intent as R2

Open spaces are all uphill and give no buffering advantage

Also creates a safety issue/delay in getting through locked gates for emergency vehicles.



	PUD	Ordinance
Length of roadway	2,888	750
width of roadway	28	30
acres of roadway	**1.86**	**0.52**
Percentage increase in road	**359%**	-
Total Impervious surface	**46%**	
Total Acres	**20**	
Runoff/day 100 year rain	**1.66 Mill**	**~0.4 Mill**

Does not include the additional runoff due to the 40 homes and driveways versus ordinance limit of 24 (+16 homes/drives)

Sec. 10-06 Development Standards and Guidelines

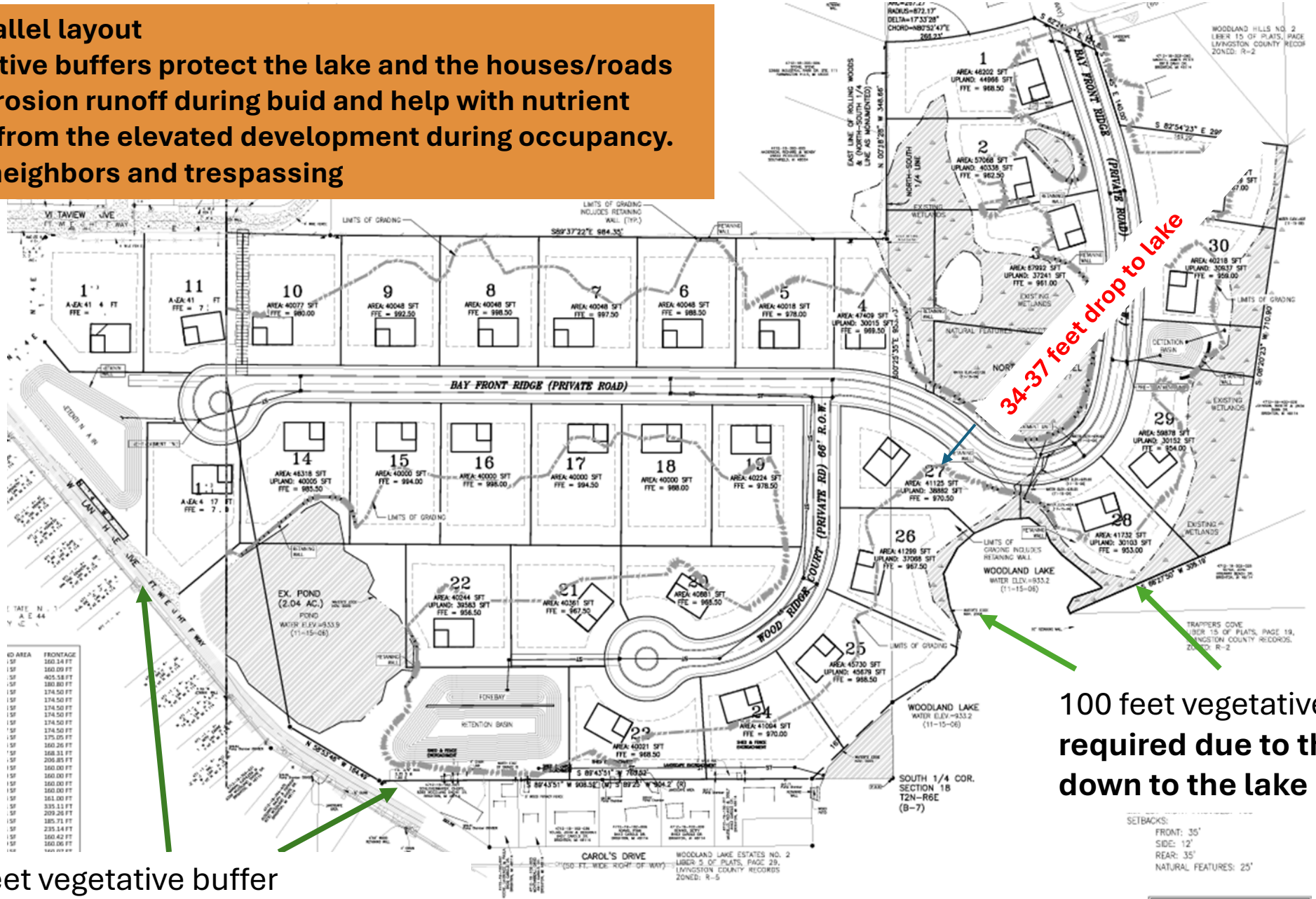
(f) Lakes, Ponds, and Streams. If the development site contains a lake, pond, or stream, the development plan *shall* include enhancements and restoration as necessary to provide wildlife habitat and improve the aesthetic quality in areas of the shoreline. The development plan *shall* also include a design that addresses erosion control protection and shoreline landscaping on or adjacent to the lots or tracts.

MCL 750.552, Michigan State Statute that governs trespassing of water and erosion.

This comes into play when the erosion and flooding from the building process runs onto the homes between the development and the lake. As we know, silt fencing does very little to counteract erosion and flooding with these steep slopes from the development. It also applies to erosion running off into the lake and wetlands from the build process.

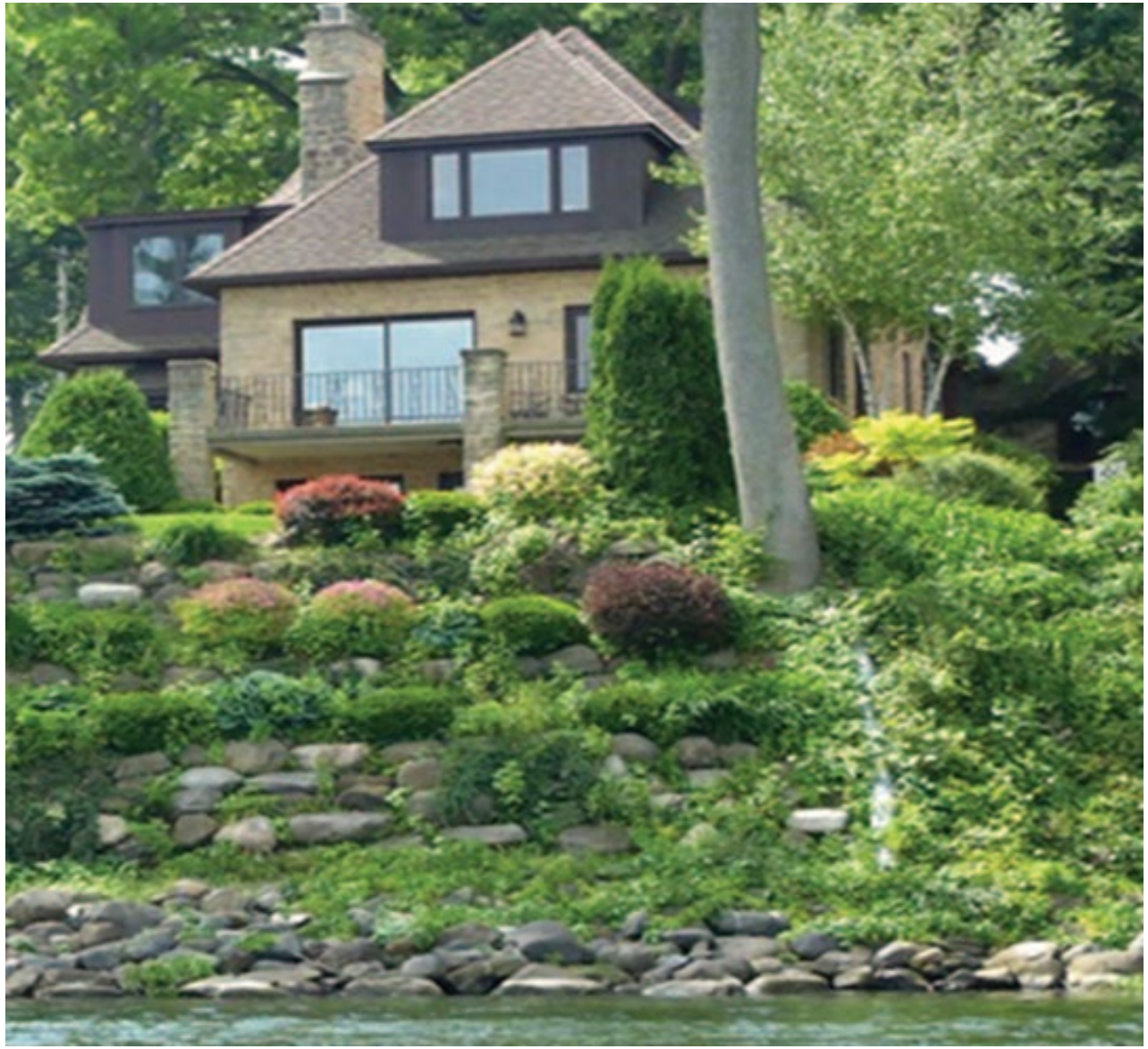
Following pages describe approaches to help reduce erosion issues during build, as well as helping reduce environmental impacts during occupancy

R2 parallel layout
Vegetative buffers protect the lake and the houses/roads from erosion runoff during buid and help with nutrient runoff from the elevated development during occupancy.
Good neighbors and trespassing



100 feet vegetative buffer
required due to the steep grade down to the lake in these areas.

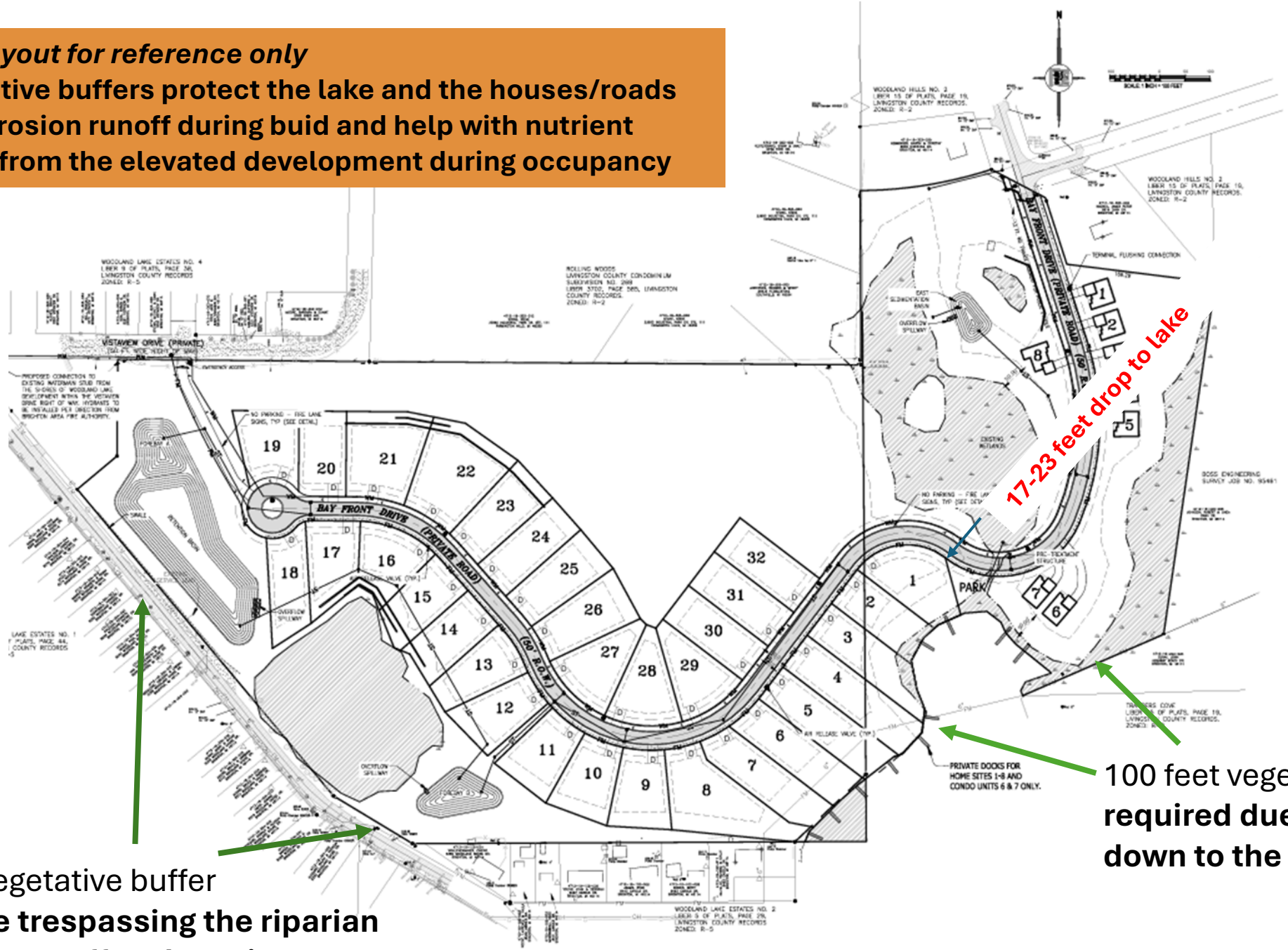
50 feet vegetative buffer
minimize trespassing the riparian lots from runoff and erosion



Vegetative buffer example. Requires deep root, dense plantings

PUD layout for reference only

Vegetative buffers protect the lake and the houses/roads from erosion runoff during buid and help with nutrient runoff from the elevated development during occupancy



50 feet vegetative buffer **minimize trespassing the riparian lots from runoff and erosion**

100 feet vegetative buffer **required due to the steep grade down to the lake in these areas.**

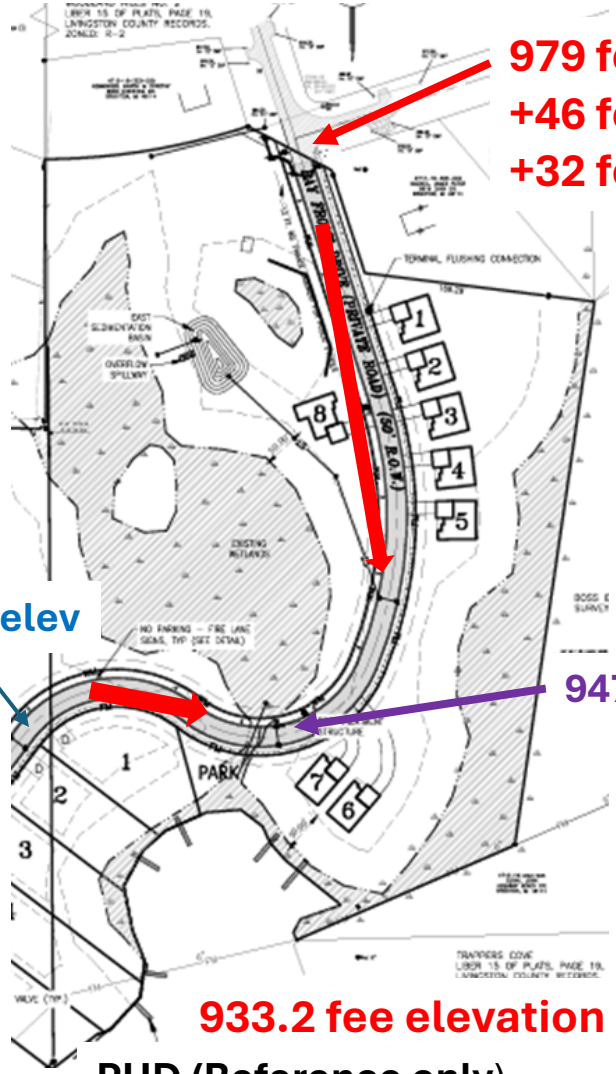
ARTICLE 24 WETLAND AND WATERWAYS PROTECTION

Sec. 24-05 Acts Requiring Permits

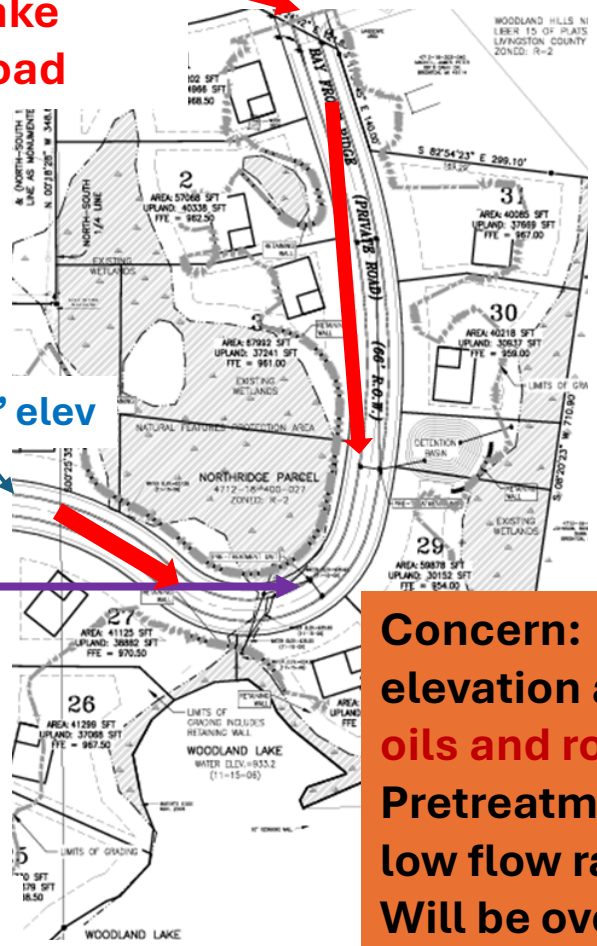
(b) Drain or causing to be drained, any water into or from a wet land, **wetland edge or watercourse** which is **contiguous to a lake or stream**, or to a tributary of a lake or stream, or to a wetland or wetland edge or watercourse being preserved for the public interest.

(f) **Drain surface waters from man-made structures including roads, parking lots, retention and detention basins,** agricultural runoff into wetland, wetland edge, or watercourse, including any other land or water use permitting the **discharge of silt, salts, sediment, organic or inorganic materials, chemical, fertilizers, flammable liquids**, or any substance producing turbidity, dyes, insecticides, herbicides, or detergents.

N. Christine and Dann Drive increase to over 1,000 feet elevation and feed into this road



979 feet elevation
+46 feet to lake
+32 feet to road



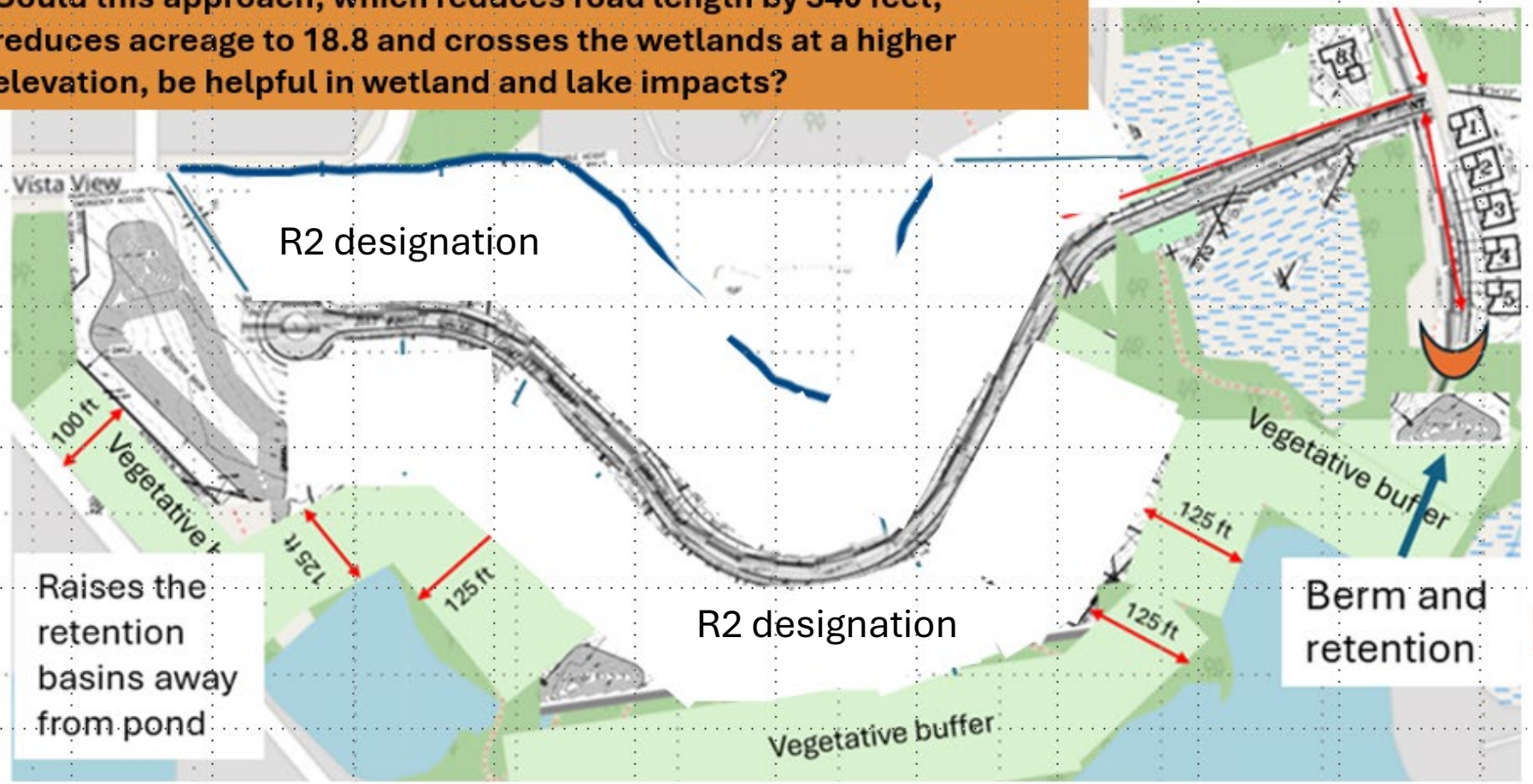
PUD (Reference only)
1.71 acres
0.51 C factor
83K gals/hr
156K gals/day

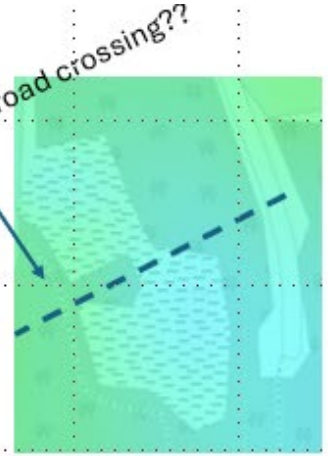
R2
1.83 acres
0.50 C factor
87K gals/hr
164 K gals/day

Concern: High velocity water streaming down from high elevation and bypassing drains, overflowing into lake with oils and road contamination.
Pretreatment structure will pull 80% of sediment out of low flow rains.
Will be overwhelmed by heavy rains
Will not absorb oils, chemicals or nutrients, will flow directly into the wetlands and lake

Conceptual proposal only

Could this approach, which reduces road length by 340 feet, reduces acreage to 18.8 and crosses the wetlands at a higher elevation, be helpful in wetland and lake impacts?





	Runoff Coefficient, C					
	Soil Group A			Soil Group B		
Slope :	< 2%	2-6%	> 6%	< 2%	2-6%	> 6%
Forest	0.08	0.11	0.14	0.10	0.14	0.18
Meadow	0.14	0.22	0.30	0.20	0.28	0.37
Pasture	0.15	0.25	0.37	0.23	0.34	0.45
Farmland	0.14	0.18	0.22	0.16	0.21	0.28
Res. 1 acre	0.22	0.26	0.29	0.24	0.28	0.34
Res. 1/2 acre	0.25	0.29	0.32	0.28	0.32	0.36
Res. 1/3 acre	0.28	0.32	0.35	0.30	0.35	0.39
Res. 1/4 acre	0.30	0.34	0.37	0.33	0.37	0.42
Res. 1/8 acre	0.33	0.37	0.40	0.35	0.39	0.44
Industrial	0.85	0.85	0.86	0.85	0.86	0.86
Commercial	0.88	0.88	0.89	0.89	0.89	0.89
Streets: ROW	0.76	0.77	0.79	0.80	0.82	0.84
Parking	0.95	0.96	0.97	0.95	0.96	0.97
Disturbed Area	0.65	0.67	0.69	0.66	0.68	0.70

Rational Method Runoff Coefficients - Part I

R2 designation can be built to more appropriate Runoff Coefficients
Reduce the road and cul-de-sacs

The Brighton Township Trustees and planners are responsible for protecting the citizens of Brighton Township.

This includes the enforcement of ordinances to maintain the community's quality of life.

Organization of Woodland Lake has presented numerous times to the Township and Livingston County the precarious water quality issues that our lake is struggling with due to an excess of Nutrients coming into our lake and not enough vegetation remaining to absorb them. (This was intended to be a working meeting to try to help.)

Well over 200 studies around the United States demonstrate that overbuilding around lakes is the key factor in the nutrient overloading. We've shown you that our data supports that fact.

The most effectively implemented Best Management Practices (BMP's) for stormwater runoff mitigation are not effective above 25-30% impervious surfaces. We have shown you some of these concerns here

This woodlands and wetlands area is the last one remaining on our lake to help in this absorption of nutrients.

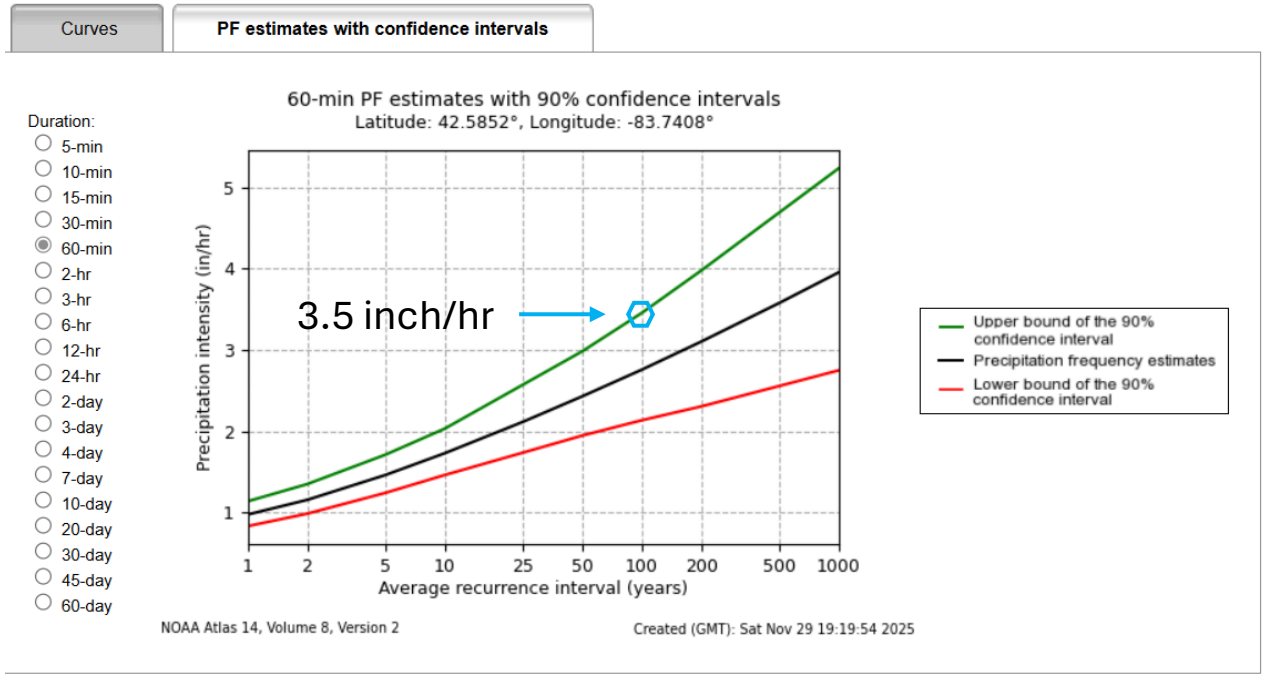
The deviation for road length is inappropriate for any lakefront development (Master plan defines road length ass a protection for water quality). This is a Township controlled issue that is enabling over 4 times the stormwater runoff from this development than following the ordinance would.

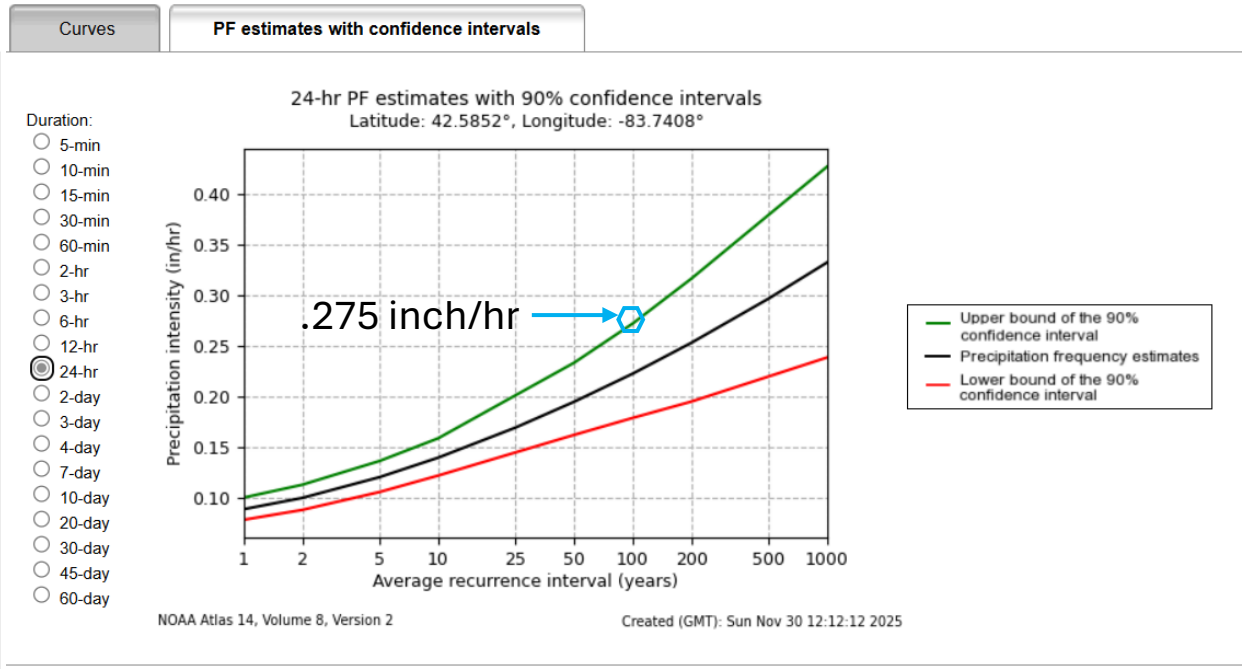
The resultant PUD that is being considered is circumventing the intent of the R2 zoning, combined with the road length deviation. (Article 12, Section 12-01 (c)). The County recognized this and denied this proposal due to environmental damage.

OWL is not against this development, it needs to be more responsibly done. The ordinances noted, along with others, give the Township the power to help. The damages from this development, as proposed. Will do harm to the aquatic life in our lake, your citizens and the visitors to our lake.

Please use the ordinances that are available to do the right thing and reduce the large, highly impervious nature of this development.

Backup Info





EGLE references NOAA for rain intensity charts for regions of development

NOAA 100 year rain events, to be protected for up to a 24 hour event, include:

1 hour at 3.5 inches/hour and
24 hours at .275 inches/hour (6.6 inches per day)

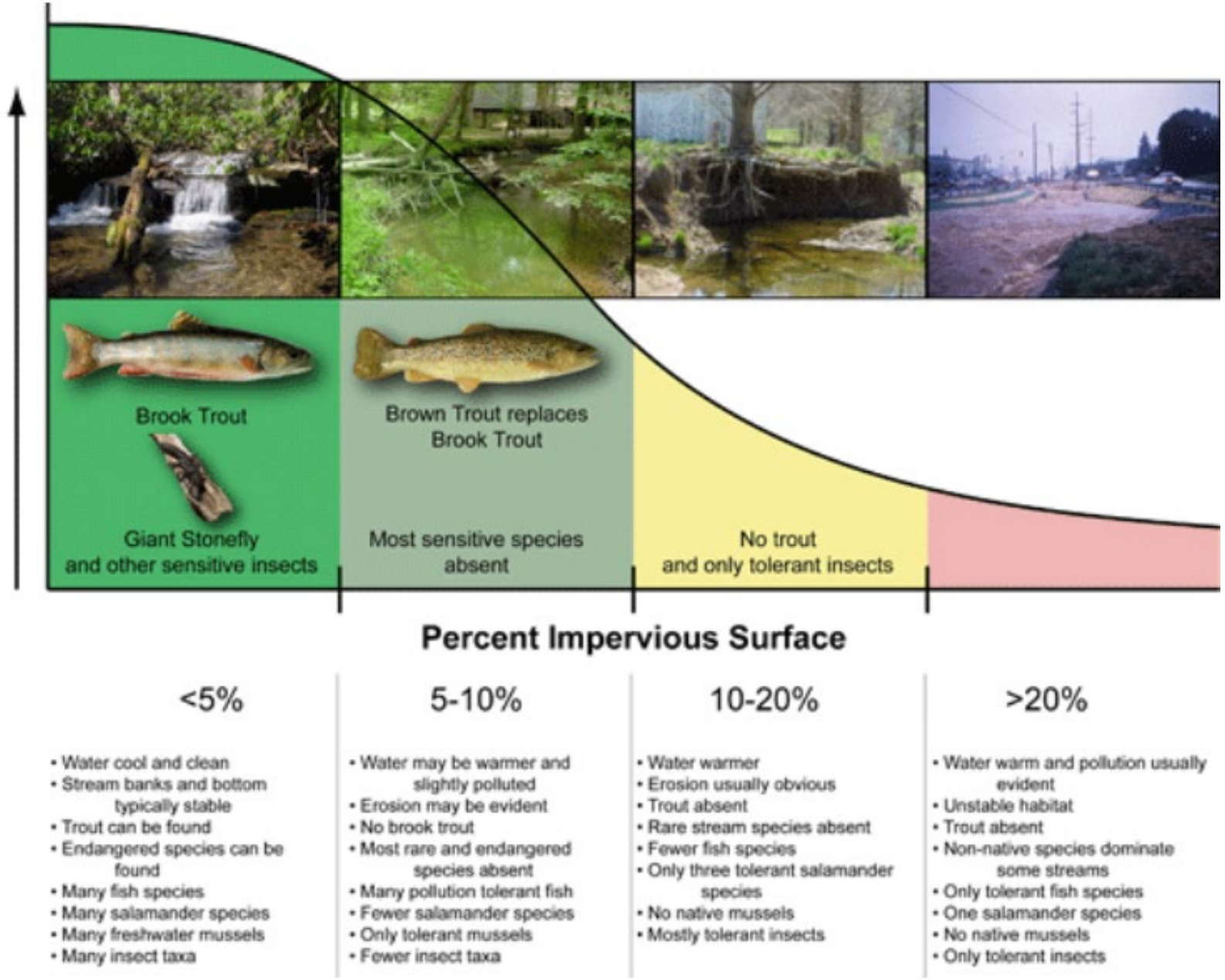
1 inch of rain over 1 acre of earth equals **27,164** gallons of water. Must protect for 100 year rain, 1 hour through 24 hours.

Flow calculations for the Stormwater Mgmt Rational Model:
Runoff flow Gallons/hr = Area in acres * Weighted C Factor * Inches rain/hr * 27,164 gallons/inch/acre

From Michigan EGLE document labeled “protecting Michigan Inland Lakes”_

Stormwater Management Best Practices

- Prohibit the discharge of stormwater to wetlands and the use of natural wetlands to treat stormwater – instead encourage low impact development, creation of rain gardens, green roofs, wet detention basins and other engineered solutions.
- Control quantity, timing, and quality of runoff.
- Set a limit for impervious areas, require pervious (porous) surfaces whenever possible, and reduce parking requirements.
- Reduce design demands for curbs and gutters, allow replacement with grassed swales where appropriate.
- Protect and restore green infrastructure, such as wetlands and other natural landscapes and drainage ways.
- Ensure proper installation and require routine maintenance of stormwater control measures.
- Treat “first flush” runoff - the runoff that occurs at the beginning of a rainstorm and generally contains a higher concentration of pollutants.
- Protect natural vegetation along shorelines and streambanks with natural features setbacks.
- Prevent filling in wetlands, floodplains, and other natural stormwater collection areas.
- Require a stormwater management plan at the site plan review stage for new, modified or expanded developments.



These 2 charts demonstrate prior DNR/USDA studies that indicate the negatives of overbuilding around waterways and lakes.
Every additional square foot of impervious surface (Roads, parking areas, shingle roofs, etc) adds significantly to degradation of our lake.
Every additional person/family also contribute to contamination, cars, fuels, oils, home maintenance waste, etc.

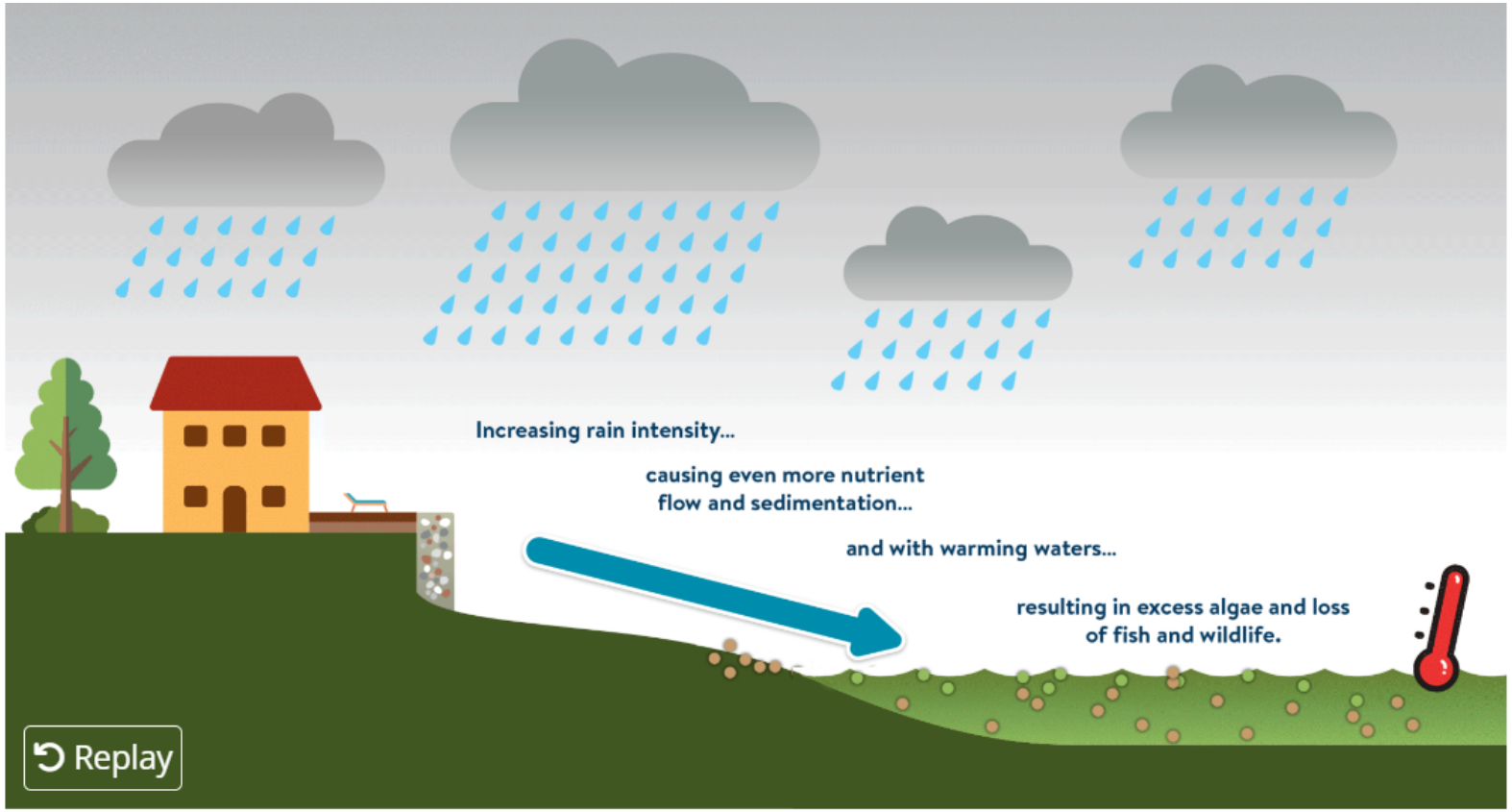
DEPARTMENT OF NATURAL RESOURCES

How vegetation loss makes lakes and rivers more vulnerable to algae growth

Natural shoreline retained

In this scenario, the lake home is set back from the water and most of the existing natural vegetation between the home and the lake and along the shoreline is left intact (Figure 1). This vegetation holds soil in place and slows down nutrient-laden runoff, increasing infiltration and decreasing the amount of nutrients flowing into the lake. In this more natural condition, nutrient flow is in equilibrium with the needs of aquatic life resulting in clean water and habitat that supports healthy fish and wildlife.

This study, from Minnesota Department of Natural resources, is one of many that demonstrates how we have overbuilt our inland lakes and are damaging their health for humans and aquatic life



Continued contemporary shoreland development along with more intense rain events and warming waters are accelerating the growth of algae and aquatic plants and loss of clean water. Unless the flow of nutrients to our lakes and rivers are reduced, we face:

- Growing health and safety concerns for our families and pets due to more frequent and long-lasting algal blooms, some toxic.
- Reduced swimming and other in-water activities due to increases in aquatic plants and algae.
- Loss of fish and wildlife species we associate with natural areas, including loons.
- Loss of recreational tourism businesses due to loss of fisheries and/or declining water quality.
- Decline in shoreline property values and tax base due to declining water quality.


VISTAVIEW DR
WOODLAND SHORE DR
WOODLAND SHORE DR
POINT DR
CAROLS DR
3D

On a 30% grade, a 100-foot vegetative buffer designed for flat land would likely need to be increased to approximately **150 to 200+ feet** to provide equivalent nutrient absorption and erosion control.

Steeper slopes increase runoff velocity and reduce infiltration time, necessitating a wider buffer to maintain the same pollutant removal efficiency as a flat area.

Key Considerations for 30% Slopes

- **Buffer Expansion Factor:** While a 100-foot buffer might be sufficient for a 0–5% slope, literature often suggests increasing the width by 2 feet for every 1% increase in slope, or significantly lengthening it for steep slopes.
- **Effectiveness on Steep Slopes:** Buffers on slopes over 15% or 20% are significantly less effective than on gentle terrain. A 30% slope is considered very steep in this context.
- **Minimum Requirements:** For slopes exceeding 20%, some guidelines recommend doubling or tripling the standard width.
- **Maximum Limits:** USDA recommendations for buffer strips allow them to be widened up to a maximum of 216 feet depending on soil and slope constraints.

Mitigation Strategies for Steep Slopes

Because a wider buffer may not be feasible or solely effective, other practices should be combined with the vegetation:

- **Terracing:** Break up the slope into smaller, flatter terraces to slow down water.
- **Engineered Controls:** Use sediment basins, check dams, or crushed stone on the uphill side to slow runoff velocity.
- **Vegetation Type:** Use deep-rooted, sturdy native plants, shrubs, and trees rather than just grass to provide better soil structure (woody rebar).

Disclaimer: You should check local shoreland zoning ordinances, as they often have specific, mandated buffer requirements based on slope percentage.

Rainfall exceeding 4 inches in a single day has become a more frequent, "new normal" occurrence in Southeastern Michigan, particularly driven by intense summer thunderstorms. While historically rare, such events have occurred multiple times in the last decade, with major, heavily documented, or widespread events happening in **August 2014, September 2016, July 2021, and September 2021**.

Key Instances of 4+ Inch Rainfall in Southeastern Michigan

- **June 25-26, 2021:** Widespread totals of 4 to over 6.5 inches fell across Metro Detroit (including Dearborn, Garden City, and Detroit), leading to a state of emergency in Wayne County.
- **August 11, 2014:** A historic event dropped 4 to 6 inches of rain in a 4-hour period across Wayne, Oakland, and Macomb counties, causing massive flooding.
- **July 2021:** Multiple rounds of storms in July 2021 resulted in several locations receiving 3-4+ inches of rain.
- **June 2024:** Certain areas in Southern Michigan reported just over 4 inches of rain in a few hours.

Trends and Frequency

- **Increasing Frequency:** Researchers have noted a 128% increase in the frequency of extreme precipitation events (2+ inches in a day) in southern Michigan over the last 50 years.
- **Intensifying Storms:** The amount of rain falling in the most extreme 1% of precipitation events has increased by 42% in the Midwest since the 1950s.
- **"Training" Storms:** These 4+ inch events are often caused by storms "training"—moving over the same locations repeatedly, as seen in the August 2014 and June 2021 floods.
- **Infrastructure Impact:** These events often overwhelm regional pumping stations and drainage systems.

Native Plant Buffers and Shoreline Restoration

Native plants create functional buffers that filter runoff, stabilize soil, and provide habitat for birds, pollinators, and aquatic life. Replacing lawns that run to the water's edge with layered plantings — grasses, shrubs, and trees — reduces erosion and improves water quality. Restoration often includes removing invasive species and reintroducing plants adapted to local hydrology.

Permeable Surfaces and Reduced Impervious Area

Driveways, patios, and walkways crafted from permeable pavers, crushed stone, or porous concrete allow rainwater to infiltrate the ground rather than flow directly into the lake. Reducing impervious cover diminishes peak runoff and helps recharge aquifers. Thoughtful placement of structures and parking areas reduces the footprint of hardscape on the site.

Naturalized Shoreline Access

Access to the water does not need to come at the cost of ecosystem health. Boardwalks, narrow staircases, and discreet docks minimize trampling and maintain the continuity of shoreline vegetation. Floating docks and seasonal structures help protect fish spawning areas and allow the shoreline to respond naturally to changing water levels.